HAZARD RANKING SYSTEM (HRS)
DOCUMENTATION RECORD - REVIEW COVER SHEET

Name of Site: MacMillan Ring Free Oil

EPA ID No.: ARD008049207

Contact Persons

Site Investigation:	Brenda Nixon Cook, NPL Coordinator, EPA Reg.6 (Name)	(214) 665-7436 (Telephone)
Documentation Record:	Brenda Nixon Cook, NPL Coordinator, EPA Reg.6 (Name)	(214) 665-7436 (Telephone)

Pathways, Components, or Threats Not Scored

Although the surface water migration pathway score is sufficient to list the site, contamination in other media has been identified that may pose a threat to human health and the environment and may be evaluated in the future (Ref. 5).

1) Ground Water Pathway: The ground water migration pathway has not been scored because, based on information available at this time, scoring of the ground water migration pathway would not significantly affect the listing decision (Ref. 1, Sec. 2.2.3).

2) Soil Exposure Pathway: The soil exposure pathway has not been scored. Based on information available at this time, evaluation of the soil exposure pathway would not affect the listing decision (Ref. 1, Sec. 2.2.3).

3) Air Pathway: The air migration pathway has not been scored. Based on information available at this time, evaluation of the air migration pathway would not affect the listing decision (Ref. 1, Sec. 2.2.3).

4) Surface Water Pathway: The Surface Water Pathway has been scored for the Human Food Chain Threat and Environmental Threat. The drinking water threat has not been scored. Based on information available at this time, evaluation of the drinking water threat would not affect the listing decision (Ref. 1, Sec. 2.2.3).

HRS DOCUMENTATION RECORD

Name of Site: MacMillan Ring Free Oil

Site Spill Identifier No.: 063T

CERCLIS Site ID No.: ARD008049207

EPA Region: 6

Date Prepared: December 2013

Street Address of Site: MacMillan Road off Arkansas Highway 335*

City, County, and State: Norphlet, Union County, Arkansas 71759*

General Location within the State: The site is located in the City of Norphlet, Union County, Arkansas. Norphlet is located in south-central Arkansas (Ref. 3, p. 1).

Topographic Map(s): The following U.S. Geological Survey (USGS) 7.5-minute topographic series map was used in locating the site: Smackover, Arkansas (1962) (Ref. 3, p. 1).

Latitude/Longitude*: 33° 18’ 30.096” N, 92° 39’ 24.769” W

Latitude and Longitude coordinates were measured from the northern side of Source 2 where Ponds 705-707 were historically located and were determined using a scaled topographic map and Geographic Information System (GIS) software (Ref. 4, pp. 1-2).

Scores

Air Pathway	Not Scored
Ground Water Pathway	Not Scored
Soil Exposure Pathway	Not Scored
Surface Water Pathway	100.00
HRS SITE SCORE	**50.00**

*The street address, coordinates, and contaminant locations presented in this HRS Documentation Record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of property boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

NOTES TO THE READER

1. The following rule applies when citing references in this documentation record:

   Tracking numbers are assigned by the region to every page of every reference. The tracking number consists of the reference number followed by the page number within that reference. A tracking number has a two-digit number followed by the sequential number (e.g., Reference 4, page 1 is expressed as 040001in Reference 4).

2. Hazardous substances are listed by the names used in the January 2004 (with March 2012 update) Superfund Chemical Data Matrix (SCDM) (Ref. 2).

3. Attachment A of this documentation record consists of the following figures:

   - A-1 Site Location Map
   - A-2 Property Layout Map
   - A-3 Surface Water Pathway Map
   - A-4 15-Mile Target Distance Limit
   - A-5 Sample Location Map

REFERENCES CITED

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4. Weston Solutions, Inc. (WESTON®). 2013. Project Note to File. Calculating the Latitude and Longitude coordinates of the Site. 24 July 2013. Pages: 2.

5. WESTON. 2013. T rip Report for MacMillan Ring Free Oil Co. Inc. (excerpts). Norphlet, Union County, Arkansas. ARD008049207. 28 May 2013. Pages: 147.

6. Arkansas Department of Environmental Quality (ADEQ). 2011. Comprehensive Site Assessment. Norphlet Chemical (MacMillan Ring Free Oil). Norphlet, Union County, AR. 25 April 2011. Pages: 584.

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18. National Drought Mitigation Center, United States Department of Agriculture (USDA) and the National Oceanic and Atmospheric Administration (NOAA). 2012. U.S. Drought Monitor. 23 August 2012. Pages: 1.

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SITE SUMMARY

MacMillan Ring Free Oil (MacMillan) has also been referred to as Norphlet Chemical in several of the historical documents referenced. These two separate facilities have been located on the same property, at different times, and operated by different owners, but the focus of this HRS Documentation Record is historical operations that occurred during ownership by MacMillan. Norphlet Chemical did not use the sources identified in this HRS Documentation Record.

The former MacMillan Ring Free Oil site is located on MacMillan Road off Arkansas Highway 335, Norphlet, Union County, Arkansas (Ref. 3, p. 1; Ref. 5, p. 2). The facility boundary is approximately 100 acres as depicted on Attachment A, Figure A-2. The facility is bordered by a residential subdivision and the Norphlet Public Schools complex (which includes kindergarten through 12th grade) on the west, a city park and baseball fields to the northwest and Hayes Creek to the north and east. In addition, railroad tracks run east of the facility with railroad spurs on the eastern portion of the property. To the south are undeveloped woods, the City of Norphlet Wastewater Treatments Ponds, and Massey Creek (Attachment A, Figure A-1; Ref. 5, p. 2; Ref. 6, p. 10).

During MacMillan's operation there were numerous tanks located throughout the property as seen in a plant layout map included in the MacMillan Closure Report (Ref. 27, p. 11). During a 1980 EPA Preliminary Assessment of the facility, 167 tanks with a total capacity of 510,000 barrels of refined products were identified (Ref. 20, pg. 21). In addition, a 50,000-barrel bulk crude AST was still on-facility in January 2012, but had been removed when a site visit from EPA contractors occurred in August 2012 (Ref. 6, p,. 21; Ref. 15, p. 72; Ref. 30, p. 3). To the north of the facility was a group of ASTs that were used for asphalt storage. In January 2012, these tanks were in various stages of disrepair, and several tanks had been removed (Ref. 15, pp. 80-86). During a June 2012 site visit by EPA contractors, these tanks were observed to have been removed (Ref. 30, p. 3).

The former Boiler House, located west of Source 4, is still located on the property, with the boiler equipment still in place. The building is currently locked with asbestos hazard warning signs (Ref. 6, p. 21). The former canning building and drum storage building are still currently located on-property, with chemicals observed throughout both areas (Ref. 6, p. 23). Several 55-gallon metal and plastic drums were observed throughout the western and northern portions of the canning building. Some drums were physically damaged, dented, and or leaking. Additionally several bags of chemicals were located within the buildings, with physical conditions of the storage bags ranging from well wrapped with plastic to ripped and torn. The southwestern portion of the canning building contained numerous 5-gallon buckets and 1-liter containers of named and un-named chemicals. At least three unlabeled 1,000 gallon plastic storage tanks enclosed by metal frames were observed and contained a brown liquid. Concrete flooring throughout the building had observable staining (Ref. 6, pp. 24, 146-162).

The area west of the canning and drum storage building is gravel covered with a number of metal pipe racks with process piping still in place. West of the piping racks is the area used by Norphlet Chemical for their manufacturing operation. All of the storage tanks, tower, and process vessels and piping are still in place from the Norphlet Chemical operation. Storm water from this area of the facility drains westward to a new small wastewater treatment system which is located on the eastern edge of the former wastewater treatment plant. A water leak was discovered from a system of sumps from the

Norphlet Chemical process area. The runoff from the leak was flowing towards the Fire Water Pond located to the south (Ref. 6, p. 24).

The MacMillan facility is currently partially fenced along the west side of the property, but there is no fence along the railroad tracks to the east. Debris piles consisting of piping, empty drums, and used equipment and parts are located throughout the property. These piles are not located on plastic or covered (Ref. 6, pp. 11, 133, 137). Eleven large surface impoundments (referred to in historical documents as ponds) were previously located on the south side of the facility and the east side of the railroad tracks (Ref. 20, pp. 22-32; Ref. 23, pp. 38, 40). These ponds have been backfilled, and are marked by open areas covered by sparse vegetation; these open areas are also visible in Attachment A, Figure A-2.

For HRS scoring purposes, the site consists of two sources which consist of buried/backfilled surface impoundments, along with a release of hazardous substances to nearby surface water bodies.

The facility has a long history of industrial operations that are summarized as follows:

- As early as 1929, the facility and surrounding property operated as a crude oil refinery and manufacturer of lubrication oil and asphalt products. During this time, the facility was called MacMillan Ring Free Oil Company, Inc. (Ref. 6, p. 34; Ref. 12, pp. 2, 4). In 1987, operations ceased due to an involuntary bankruptcy (Ref. 7, p. 5).
- In 1987, Nor-Ark Industrial Corporation obtained a permit to discharge wastewater to nearby receiving waters at the property (Ref. 13, p.1) and eventually purchased the property in 1989 (Ref. 10, p. 10; Ref. 14, p. 1). Nor-Ark Industrial provided storage tank leasing for asphalt products until filing for bankruptcy in 1991 (Ref. 6, p. 10; Ref. 10, p. 10).
- In 1999, Norphlet Chemical Storage Inc. purchased the property at an auction. The property included approximately 106 acres that was part of the former MacMillan Ring Free Oil Refinery. The 106 acres that comprised MacMillan Refinery included a 94.8-acre tract of land west of the railroad and the 10.7-acre tract of land east of the railroad (Ref. 6, p.34).
- In 2004, Norphlet Chemical Storage, Inc. sold the 94.8-tract of land to Norphlet Chemical Properties, Inc. or Norphlet Chemicals, Inc. (NCI) (Ref. 6, p.34). NCI planned to produce 1,1,2,2-tetrafluoroethane (Freon 134A) refrigerant from anhydrous hydrofluoric acid and trichloroethylene. The plant never operated as intended and filed for bankruptcy in 2008 (Ref. 12, p. 1).

Regulatory Enforcement History

Multiple phases of investigation have occurred at the property since 1980. These investigations and the regulatory history of the facility were obtained from the Arkansas Department of Environmental Quality (ADEQ) and are summarized in the following text.

During ownership of the facility, MacMillan encountered both state and federal enforcement actions for multiple violations, including release of oilfield waste to Arkansas state waters, improper storage of hazardous waste, failure to perform required ground water monitoring and failure to implement approved closure plans for on-property impoundments (Ref. 9, pp. 1, 7, 10, 19).

In 1980, MacMillan Refinery filed a Notification of Hazardous Waste Activity Part A application with the United States Environmental Protection Agency (EPA). During its operations, MacMillan used dissolved air flotation (DAF) systems as a part of their wastewater treatment process from 1975 until 1987. The DAF sludge located in three surface impoundments on the property (Ponds, 705, 706, and 707) contained petroleum waste products classified as hazardous waste (K048) under 40 Code of Federal Regulations (CFR) §261.32 (Ref. 27, p.2). Since the DAF impoundments contained a hazardous waste, a ground water monitoring system was required. For years, MacMillan communicated with EPA that they did not agree that the DAF should be regulated as hazardous waste and continued utilizing the impoundments without a ground water monitoring system (Ref. 9, pp.2-3; Ref. 7, pp. 2 -4; Ref. 27, p.2). During that time, several overflows to Hayes Creek from the DAF impoundments and other impoundments occurred (Ref. 8, pp. 5-6, 9; Ref. 9, p.1).

On 21 September 1984, the EPA issued a Compliance Order and Notice of Opportunity for Hearing against MacMillan Refinery charging the company with failure to install a ground water monitoring system (Ref. 8, pp. 1 -2). In August 1985, Arkansas Department of Pollution Control and Ecology (ADPC&E) ordered MacMillan to either install the necessary controls for the impoundments containing hazardous waste to comply with its RCRA Part B Permit, or submit a closure plan (Ref. 7, p. 1). The MacMillan facility did not comply with either order and, in 1986, ADPC&E terminated MacMillan's status as a Treatment, Storage, Disposal (TSD) facility, and directed them to implement a closure plan for the on-property surface impoundments (ponds) (Ref. 10, p. 11). A closure plan was prepared by MacMillan and modified by ADEQ in May 1986, but the facility filed for bankruptcy before the plan was implemented (Ref. 7, p. 5).

Nor-Ark purchased the property in 1989, assuming liability for all chemicals and contaminated media on the property, but did not implement any ground water monitoring or the impoundment closure plan mandated by ADEQ (Ref. 7, pp. 1, 3). Nor-Ark also incurred several environmental violations during its ownership of the property. These violations ranged from failure to close the hazardous waste impoundments and monitor ground water (Ref. 7, p. 1; Ref. 9, p. 6; Ref. 11, pp. 2, 5, 8), failure to maintain 12-inch freeboard on the impoundments (Ref. 9, p. 7), unpermitted discharges, improper storage of hazardous wastes, and failure to meet administrative and reporting requirements (Ref. 9, pp. 7-21; Ref. 10, pp. 2-3, 21-22), to violations of asbestos regulations (Ref. 8, pp. 8, 10-12). By 1990, Nor-Ark had dismantled most of the facility and sold the majority of the equipment and fixtures (Ref. 14, p. 2). In March 1991, Nor-Ark filed for bankruptcy (Ref. 6, p. 10).

During its ownership under Nor-Ark, and after the Nor-Ark bankruptcy, a number of facility visits by EPA, EPA contractors, and ADPC&E documented evidence of overflow from the ponds and oily material released to the environment (Ref. 9, pp. 7-21, 23-25, 27-28). A series of EPA Superfund removal actions were conducted from 1992 through 1997 to address the immediate issue of release to the environment (Ref. 9, pp. 28-30). These removal actions included the following:

- In 1992, approximately 31,500 gallons of free-floating oil materials were recovered from impoundments, and oil and oil-contaminated vegetation along Hayes Creek and Massey Creek were removed (Ref. 8, p. 11).
- In 1993, approximately 9,600 gallons of composite waste/flammable corrosive liquids and 50,080 gallons of waste oil were removed and transported off-property. Asbestos on the facility (found in buildings and piping) was also abated and transported off-property for

disposal. Removal activities of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)- regulated wastes had ceased, and the remaining waste at the facility was slated for removal under the Oil Pollution Act (OPA) (Ref. 8, pp. 13, 22-23).

- From 1994 through 1997, removal actions continued with pumping, treating, and discharging of OPA and CERCLA-regulated wastes from the impoundments into the surrounding creeks and conducting on-site bioremediation of approximately 43,000 cubic yards of contaminated soil (Ref. 8, pp. 26-27; Ref. 9, pp. 40 -41). The on-site biodegradation of impoundment sediments were treated on-site within land treatment units (LTUs). OPA and CERCLA wastes were treated at the same time within 13 separate batches, and bioremediated soils from all impoundments (OPA and CERCLA) were used to backfill the impoundments (Ref. 8, pp. 26-27; Ref. 45, pp. 5, 6).

EPA's removal actions were conducted to mitigate the imminent threat to the public health and environment; however, these removal actions did not address environmental concerns of total petroleum hydrocarbon (TPH)-contaminated soil and contaminated surface water runoff that existed at the facility (Ref. 6, p. 37; Ref. 9, pp. 41-43).

The facility historically has had a mix of OPA and CERCLA wastes. It was discovered near the end of the OPA response, from state records and conversations with a former employee, that the impoundments (ponds) had been contaminated with the following listed Resource Conservation and Recovery Act (RCRA) hazardous wastes generated by petroleum refining operations: K048- DAF, K049 – slop oil emulsion solids, K050 – heat exchanger bundle cleaning sludge, K051- American Petroleum Institute (API) separator sludge, and K052 – tank bottoms. These RCRA hazardous wastes also constitute hazardous substances pursuant to Section 101(14) of the CERCLA. These RCRA hazardous wastes have commingled with the contents of impoundments that had been considered OPA regulated (Ref. 43, p. 3).

In April 2009, an ADEQ inspection prompted the State to request an emergency removal action by EPA. ADEQ had reported corrosion on tank relief valves associated with tanks containing anhydrous hydrofluoric acid (AHF) and AHF mixtures. The tanks (associated with Norphlet Chemical operations and not MacMillan) were located approximately 500 feet from the Norphlet Public School complex. Initial emergency actions conducted by EPA included removal of the AHF and AHF mixtures, construction of a scrubber to neutralize residual AHF remaining in tanks and flow lines, and decontamination of the associated tanks and piping (Ref. 17, pp. 1, 2).

Although EPA Emergency Response and Removal Actions took place on the property from 1992-1997, and in 2009, the activities performed to date were conducted to stabilize the Site, and all source materials cited in this report currently remain on-site (Ref. 6, pp. 1-27; Ref. 28, pp. 1-2).

In April 2010, the facility was placed on the State Priority List under the Arkansas Pollution Control and Ecology Commission's Regulation No. 30. The facility was listed due to the potential for soil, surface water, and/or ground water contamination on- and off-site and the need to remediate the site to protective levels (Ref. 12, p. 2).

Site Assessment History

The facility has undergone multiple assessments from 1981-2011 analyzing ground water, surface water, surface soil, subsurface soil, and sediment. Past investigations include a Site Assessment conducted by B&F for MacMillan Ring Free Oil in 1987; EPA-lead investigations in 1979, 1981, 1985, 1993, and ongoing from 1994-1997 (Ref. 6, p. 78-81); and a Comprehensive Site Assessment (CSA) commissioned by ADEQ in 2011 (Ref. 6, pp. 1-584).

The 2011 CSA performed by ADEQ contractors FTN Associates, Ltd. and Center for Toxicology and Environmental Health (CTEH) was conducted to determine the nature and extent of hazardous substances released into the environment, the potential for additional releases of hazardous substances, and the current and possible future risks to human health and the environment from the site. Results indicated contamination of the surface and subsurface soil, ground water, and surface water/sediment (Ref. 6, pp.12-13, 77-105). Contaminants of concern included polycyclic aromatic hydrocarbons (PAHs), TPH, and metals (Ref. 6, pp. 55, 91).

Many of the ground water samples collected during the CSA had hydrocarbon odors; some samples effervesced which indicated the presence of methane gas; and others were characterized by oil sheens or contained wastes (Ref. 6, p. 12). The plume of ground water contamination exists beneath the property, and given the potentiometric surface, off-property migration west of the site is not expected, and the southeast extent of the plume has not been defined (Ref. 6, p. 85).

The CSA noted extensive black hydrocarbon surface soil staining in the area of the former tank farms and drainage ditches at the facility, oil sheens on the surface of former impoundments (ponds) after rainfall events, and yellow and green stains on surface soil in the area of the former NCI plant (Ref. 6, pp. 12, 87). Surface soil sampling conducted during the CSA also identified TPH-contamination in the area of the former tank farm and the backfilled former impoundments on the east and west sides of the railroad tracks (Ref. 6, pp. 12, 87, 99), as well as one "hot spot" of PAH-contaminated surface soil located within the surface water drainage pathway directly downgradient from Tank 514 (Ref. 6, pp. 12, 99, 122). TPH was also detected in surface water samples taken from Hayes Creek, Massey Creek, the on-property firewater pond, and a drainage pathway on the east side of the facility that flows into Hayes Creek (Ref. 6, pp. 13, 91, 92, 99). Sediment samples collected from Hayes Creek indicated the presence of TPH, chromium, and lead (Ref. 6, pp. 13, 92). During the sampling event, samplers observed a sheen along portions of Hayes Creek and in the drainage ditch on the west side of the railroad tracks (Ref. 6, pp. 91, 99).

In August 2012, the EPA Region 6 Prevention and Response Branch (EPA-PRB or EPA) performed supplemental sampling for Site Reassessment (SR) at MacMillan to determine whether the site presents a threat to public health or welfare of the United States or the environment in accordance with *40* CFR *300.415*. EPA collected surface water and sediment samples from locations within Hayes Creek; sediment, surface water, and soil samples from overland flow pathways; soil waste samples from on-site sources; passive soil gas samples between the historical ground water plume boundary and the Norphlet School System complex west of the facility; and ground water samples from a background location and from monitoring wells at existing locations on the facility (Ref. 5, pp. 4, 5; Ref. 25, pp. 5-6).

The EPA Team also conducted a wetland survey on 16 August 2012 that identified that one of the former impoundments (Pond 713) east of the rail line on the property currently serves as a wetland habitat. Although the wetland evaluation was conducted under drought conditions, historically, this area has been inundated with water as observed during previous site visits and by historical aerials, and indicators of wetland hydrology were noted in the evaluation. The wetland habitat is approximately 50 feet south of former Ponds 710 through 712 on the east side of the facility and abutting a loop of Hayes Creek. (Ref. 15, pp. 38, 41; Ref. 16, pp. 1-13; Ref. 18, pp. 1; Ref. 24, pp. 1-2; Ref. 30, pp. 1-2; Ref. 42). The wetland survey also identified that Hayes Creek is a sensitive riparian habitat (Ref. 16, pp.1, 3, 4).

Results from the EPA SR sampling event indicated an observed release to the surface water pathway from the site, with some samples containing Level II concentrations. Chemicals of concern released to the pathway include metals, and semivolatile organic compounds (SVOCs). The investigation identified two sources and six probable points of entry where hazardous substances from the sources were entering the surface water pathway. The two sources identified are the three separate backfilled former surface impoundments (ponds) on the east side of the railroad tracks (Pond 710, Pond 711, and Pond 712), and the area of the backfilled former impoundments west of the firewater pond (Ponds 704-707) (Ref. 5, p. 13; Ref. 5, pp. 14-18). Analytical results for samples collected at probable points of entry to Hayes Creek, and from within Hayes Creek itself, indicated the presence of metals, and SVOCs. Analytical results for samples collected at the probable point of entry to the wetland contiguous to Hayes Creek (PPE-03) and the wetland itself also indicated the presence of metals and SVOCs (Ref. 5, pp. 6, 13; Ref. 5, pp. 26-31, 20; Ref. 19, pp. 6-12).

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	NS	NS
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100	10,000
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	NS
2c.	Surface Water Migration Pathway Score (S_{sw}) (Enter the larger of lines 2a and 2b as the pathway score)	NS	NS
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	NS	NS
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	NS
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$	----	10,000
6.	HRS Site Score: Divide the value on line 5 by 4 and take the square root.		**50.00**

Notes:

S Score
S^2 Score squared
NS Not scored

Tables 3-1, 4-1, 4-25, 5-1, and 6-1 refer to score sheets presented in the HRS (Ref. 1). Table 4-1 is reproduced in the following pages of this HRS Documentation Record for the convenience of the reader.

DRINKING WATER THREAT - Not Scored (NS)

Factor Categories and Factors		Maximum Value	Value Assigned
	Likelihood of Release		
1.	Observed Release	550	550
2.	Potential to Release by Overland Flow:		
	2a. Containment	10	NS
	2b. Runoff	25	NS
	2c. Distance to Surface Water	25	NS
	2d. Potential to Release by Overland Flow (lines 2a[2b + 2c])	500	NS
3.	Potential to Release by Flood:		
	3a. Containment (Flood)	10	NS
	3b. Flood Frequency	50	NS
	3c. Potential to Release Flood (lines 3a x 3b)	500	NS
4.	Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	NS
5.	Likelihood of Release (higher of lines 1 and 4)	550	550
	Waste Characteristics		
6.	Toxicity/Persistence	a	NS
7.	Hazardous Waste Quantity	a	NS
8.	Waste Characteristics (Toxicity/Persistence x Hazardous Waste Quantity, then assign a value from Table 2-7)	100	NS
	Targets		
9.	Nearest Intake	50	NS
10.	Population		
	10a. Level I Concentrations	b	NS
	10b. Level II Concentrations	b	NS
	10c. Potential Contamination	b	NS
	10d. Population (lines 10a + 10b + 10c)	b	NS
11.	Resources	5	NS
12.	Targets (lines 9 + 10d +11)	b	NS
	Drinking Water Threat Score		
13.	Drinking Water Threat Score [(lines 5 x 8 x 12)/82,500 subject to a maximum of 100]	100	NS

HUMAN FOOD CHAIN THREAT

	Factor Categories and Factors	Maximum Value	Value Assigned
	Likelihood of Release		
14.	Likelihood of Release (Same value of line 5)	550	550
	Waste Characteristics		
15.	Toxicity/Persistence/ Bioaccumulation	a	5×10^8
16.	Hazardous Waste Quantity	a	10,000
17.	Waste Characteristics (Toxicity/Persistence/Bioaccumulation x Hazardous Waste Quantity, then assign a value from Table 2-7)	1,000	1,000
	Targets		
18.	Food Chain Individual	50	20
19.	Population		
	19a. Level I Concentrations	b	0
	19b. Level II Concentrations	b	0
	19c. Potential Human Food Chain Contamination	b	0.0000006
	19d. Population (lines 19a + 19b + 19c)	b	0.0000006
20.	Targets (lines 18 + 19d)	b	20.0000006
	Human Food Chain Threat Score		
21.	Human Food Chain Threat Score [(lines 14 x 17 x 20)/82,500 subject to a maximum of 100]	100	100.00

ENVIRONMENTAL THREAT

Factor Categories and Factors		Maximum Value	Value Assigned
	Likelihood of Release		
22.	Likelihood of Release (Same value of line 5)	550	550
	Waste Characteristics		
23.	Ecosystem Toxicity/Persistence Bioaccumulation	a	$5x10^8$
24.	Hazardous Waste Quantity	a	10,000
25.	Waste Characteristics (Ecosystem Tox./Persistence x Bioaccumulation x Hazardous Waste Quantity, then assign a value from Table 2-7)	1,000	1,000
	Targets		
26.	Sensitive Environments		
	26a. Level I Concentrations	b	0
	26b. Level II Concentrations	b	25
26c.	Potential Contamination		
	26c. Potential Contamination	b	0
26d.	Sensitive Environments (lines 26a + 26b + 26c)	b	25
27.	Targets (value from line 26d)	b	25
	Environmental Threat Score		
28.	Environmental Threat Score [(lines 22 x 25 x 27)/82,500 subject to a maximum of 60]	60	100 .00

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED

29.	Watershed Score [(Lines 13 + 21+ 28), subject to a maximum of 100]	100	100.00

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE

30.	Component Score (Highest score from Line 29 for all watersheds evaluated, subject to a maximum of 100)	100	100.00

SOURCE DESCRIPTION

2.2 Source Characterization

Source Description: Source 1 – Buried/Backfilled Surface Impoundments (Ponds 710, 711, and 712)

Source Type

The area to the east of the former MacMillan Refinery and the railroad tracks contained three surface impoundments (ponds) (Source 1) which had been historically used by MacMillan operations for storing crude oil. One of these ponds, historically referred to as Pond 712 as well as Pond 4 is approximately 61,000 square feet (ft^2) in area (Ref. 20, pp. 11, 20; Ref. 21). In 1980, during a Preliminary Assessment (PA) conducted by EPA contractors, Pond 712/4 was found to contain a total volume of 450,000 gallons (Ref. 20, p. 25). The pond historically referred to as Pond 711 as well as Pond 6 is approximately 12,600 ft^2 in area (Ref. 20, pp. 11, 20; Ref. 21, pp. 1-3). In 1980, during a PA conducted by EPA contractors, Pond 711/6 was found to contain a total volume of 225,000 gallons (Ref. 20, p. 27). The pond historically referred to as Pond 710 as well as Pond 7 is approximately 10,800 ft^2 in area (Ref. 20, pp. 11, 20; Ref. 21). In 1980, during a PA conducted by EPA contractors, Pond 710/7 was found to contain a total volume of 240,000 gallons (Ref. 20, p. 28).

Although historically, these ponds contained segregated wastes, during remediation activities conducted in 1995, OPA and CERCLA wastes were treated at the same time within 13 separate batches, and bioremediated soils from all impoundments (OPA and CERCLA) were used to backfill the impoundments (Ref. 8, pp. 26 -27; Ref. 45, pp. 5, 6). In November 1995, treated soil from the CERCLA regulated waste was placed back into Source 1 (Ref. 44, p. 22). According to ADPC&E, although Source 1 was backfilled with soil that was bioremediated, it is likely that there are affected soils left in place, as reportedly the financial resources were not available at the time to meet proposed cleanup criteria (Ref. 6, p. 81; Ref. 28, pp. 1-2). Sidewall contamination remained in place, as it was outside the scope of EPA Emergency Response Branch actions (Ref. 9, p. 42). The location of the backfilled Source 1 is still apparent due to lack of vegetation present (Ref. 6, p. 22; Ref. 22, pp. 10-12).

Ponds 710, 711, and 712 (Source 1) operated in the past without any freeboard, or liner and discharges to Hayes Creek were observed (Ref. 20, pp. 11, 25, 35; Ref. 23, p. 27). In 1994, Source 1 remained open and visual staining was observed on the earthen berms of the ponds (Ref. 23, p. 32). Source 1 has a history of discharging to the adjacent Hayes Creek (Ref. 20, p. 11; Ref. 23, pp. 40, 43). Historically, Source 1 overflowed during floods that were documented in December 1982 and January 1983. The oily material release covered approximately 150 to 200 acres of Ouachita River bottom (Ref. 23, p. 157).

Source 1 is classified as the HRS source type "Buried/Backfilled Surface Impoundment" (Ref. 1, Table 2-5).

Source Location

Source 1 is located approximately 150 feet east of the railroad tracks and is also located adjacent to, and abutting, the west side of Hayes Creek (Ref. 6, pp. 30, 31). The location of the backfilled Ponds 712, 710, and 711, Source 1, is depicted on Attachment A, Figure A-2.

Source Containment

Release To Surface Water

During 2012 field activities, there was no evidence of a maintained engineered cover or any run-off management system, and Source 1 functioned without a liner (Ref. 20, p. 25; Ref. 22, pp. 10-12). Although Source 1 has been backfilled, placement of an impermeable membrane was deemed too expensive during the closeout of the pond (Ref. 28, p. 2).

Containment Value: 10

2.4.1 Hazardous Substances

During a Sampling Inspection conducted in 1985 by EPA contractors, a sample was taken from Source 1. Mainly unknown organics were detected in the sample (Ref. 20, p. 11). Sampling conducted in 1992 on the sludge from Ponds 711 and 712 of Source 1, before removal activities were conducted, had the following chromium levels detected. Concentrations of chromium were at 24.9 mg/kg and 16.9 mg/kg respectively (Ref. 46, pp. 49, 50). Chromium is not a hazardous constituent associated with OPA wastes, but is associated with DAF and has been an issue at the site for a long time (Ref. 20, p. 4; Ref. 27, p. 3).

As part of SR sampling of the MacMillan facility from 13 through 17 August 2012, EPA contractors collected three solid waste samples from Source 1 (Ref. 5, pp. 5; Ref. 22, pp. 10-12; Ref. 25, p. 21). The samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs), TCL SVOCs, pesticides, and polychlorinated biphenyls (PCBs) by the Contract Laboratory Program (CLP) Statement of Work (SOW) for Multi-Media, Multi-Concentration Organic Analysis, OLM04.2, and TAL metals with mercury by CLP SOW Multi-Media, Multi-Concentration Inorganics Analysis, ILM05.3 (Ref. 25, p. 23). TCL SVOCs were also analyzed by EPA SW 846 Method 8270 for low-level PAHs (Ref. 26, pp.431-432). The samples were submitted to the EPA Region 6 Environmental Services Branch Laboratory, located in Houston, Texas (Ref. 5, p. 5; Ref. 26, pp. 1, 309, 431).

Analytical evidence of the contamination in the waste source samples associated with the backfilled Ponds 710-712 (Source 1) located on the MacMillan site is summarized below.

Hazardous Substance	Evidence			References
	Sample ID	Concentration (mg/kg)	Reporting Limit[1] (mg/kg)	
EPA SR Sampling Activities – August 2012				
Anthracene	PS-01-03-51	0.0183 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9

Hazardous Substance	Evidence			References
	Sample ID	Concentration (mg/kg)	Reporting Limit[1] (mg/kg)	
Benzo(a)anthracene	PS-01-03-51	0.0872 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Benzo(a)pyrene	PS-01-03-51	0.0617 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Benzo(k)fluoranthene	PS-01-03-51	0.163 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Benzo(g,h,i)perylene	PS-01-03-51	0.040 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Chrysene	PS-01-03-51	0.285 J	0.0224	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Dibenz(a,h)anthracene	PS-01-03-51	0.011 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Fluoranthene	PS-01-03-51	0.0832 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Indeno(1,2,3-cd)pyrene	PS-01-03-51	0.0224 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Naphthalene	PS-01-03-51	0.0927 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
2-Methylnaphthalene	PS-01-03-51	0.159 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Phenanthrene	PS-01-03-51	0.148 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Pyrene	PS-01-03-51	0.149 J	0.0056	Ref. 26, pp. 431-433, 546; Ref. 30, p. 9
Arsenic	PS-01-03-51	1.8	0.5	Ref. 26, pp. 1-3, 125; Ref. 30, p. 9
Chromium	PS-01-03-51	1,120	1.1	Ref. 26, pp. 1-3, 125; Ref. 30, p. 9
Lead	PS-01-03-51	26.0	0.5	Ref. 26, pp. 1-3, 125; Ref. 30, p. 9
Manganese	PS-01-03-51	113	0.5	Ref. 26, pp. 1-3, 125; Ref. 30, p. 9
Mercury	PS-01-03-51	0.223	0.074	Ref. 26, pp. 1-3, 125; Ref. 30, p. 9
Vanadium	PS-01-03-51	11.9	2.2	Ref. 26, pp. 1-3, 125; Ref. 30, p. 9
Zinc	PS-01-03-51	49.1	2.2	Ref. 26, pp. 1-3, 125; Ref. 30, p. 9
Acenaphthylene	PS-02-03-51	0.0107 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Anthracene	PS-02-03-51	0.0188 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Benzo(a)anthracene	PS-02-03-51	0.0372 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Benzo(a)pyrene	PS-02-03-51	0.0328 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Benzo(k)fluoranthene	PS-02-03-51	0.0721 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Benzo(g,h,i)perylene	PS-02-03-51	0.0373 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Chrysene	PS-02-03-51	0.117 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Dibenz(a,h)anthracene	PS-02-03-51	0.0067 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Fluoranthene	PS-02-03-51	0.0378 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Fluorene	PS-02-03-51	0.0378 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Indeno(1,2,3-cd)pyrene	PS-02-03-51	0.0157 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10

Hazardous Substance	Evidence			References
	Sample ID	Concentration (mg/kg)	Reporting Limit[1] (mg/kg)	
2-Methylnaphthalene	PS-02-03-51	0.122 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Naphthalene	PS-02-03-51	0.0661 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Phenanthrene	PS-02-03-51	0.116 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Pyrene	PS-02-03-51	0.0817 J	0.0044	Ref. 26, pp. 431-433, 550;Ref. 30, pp. 9-10
Arsenic	PS-02-03-51	1.2	0.5	Ref. 26, pp. 1-3, 129; Ref. 30, pp. 9-10
Chromium	PS-02-03-51	3.5	1.0	Ref. 26, pp. 1-3, 129; Ref. 30, pp. 9-10
Chromium(VI)	PS-02-03-51	2.9	0.51	Ref. 19, p. 7
Lead	PS-02-03-51	19.5	0.5	Ref. 26, pp. 1-3, 129; Ref. 30, pp. 9-10
Manganese	PS-02-03-51	89.8 J*	0.5	Ref. 26, pp. 1-3, 129; Ref. 30, pp. 9-10
Mercury	PS-02-03-51	0.114	0.067	Ref. 26, pp. 1-3, 130; Ref. 30, pp. 9-10
Vanadium	PS-02-03-51	6.5	2.0	Ref. 26, pp. 1-3, 129; Ref. 30, pp. 9-10
Zinc	PS-02-03-51	27.3	2.0	Ref. 26, pp. 1-3, 129; Ref. 30, pp. 9-10
Anthracene	PS-03-03-51	0.0117 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Benzo(a)anthracene	PS-03-03-51	0.0236 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Benzo(a)pyrene	PS-03-03-51	0.0238 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Benzo(k)fluoranthene	PS-03-03-51	0.0591 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Benzo(g,h,i)perylene	PS-03-03-51	0.0249 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Chrysene	PS-03-03-51	0.0927 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Dibenz(a,h)anthracene	PS-03-03-51	0.0048 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Fluoranthene	PS-03-03-51	0.0267 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Indeno(1,2,3-cd)pyrene	PS-03-03-51	0.0105 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Naphthalene	PS-03-03-51	0.0777 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Phenanthrene	PS-03-03-51	0.0815 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Pyrene	PS-03-03-51	0.0572 J	0.0044	Ref. 26, pp. 431-433, 554; Ref. 30, p. 10
Arsenic	PS-03-03-51	13	0.5	Ref. 26, pp. 1-3, 133; Ref. 30, p. 10
Chromium	PS-03-03-51	3.1	1.0	Ref. 26, pp. 1-3, 133; Ref. 30, p. 10
Lead	PS-03-03-51	13.1	0.5	Ref. 26, pp. 1-3, 133; Ref. 30, p. 10
Manganese	PS-03-03-51	86.4	0.5	Ref. 26, pp. 1-3, 133; Ref. 30, p. 10
Mercury	PS-03-03-51	0.132	0.071	Ref. 26, pp. 1-3, 134; Ref. 30, p. 10
Vanadium	PS-03-03-51	7.7	2.1	Ref. 26, pp. 1-3, 133; Ref. 30, p. 10
Zinc	PS-03-03-51	30.4	2.1	Ref. 26, pp. 1-3, 133; Ref. 30, p. 10

Notes:
(mg/kg) milligrams per kilogram = 1,000 micrograms per kilogram (µg/kg)
J Identification of analytes is acceptable; the reported value is an estimate because the samples were extracted past holding time. Concentrations should be considered minimum values (Ref. 26, p. 432). The estimated values are biased low (Ref. 26, p. 432; Ref. 50, p. 1).

J* Identification of analyte is acceptable; the reported value is an estimate due to outlying quality control parameters (Ref. 26, pp. 3, 695). These estimated values are biased low as the samples were extracted out of the hold time (Ref. 26, p. 432; Ref. 50, p. 1).

[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory is adjusted for sample aliquot, sample volume, and dilutions for the analysis and meets the definition of Sample Quantitation Limit (SQL) as defined by the HRS (Ref. 1, Section 1.1; Ref. 26, pp. 3, 311; Ref. 48, pp. 1-2).

Although low levels of PAHs are consistent with oil waste, these contaminants are also present within the CERCLA hazardous waste. In addition, elements such as chromium, mercury, and zinc are present within Source 1 and these contaminants are not associated with OPA wastes, but with the RCRA hazardous K048 through K052 wastes (Ref. 31, pp. 12-16, 18-23, 25).

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Tier A: Hazardous Constituent Quantity- Not Evaluated (NE)

The hazardous constituent quantity for Source 1 could not be adequately determined according to HRS requirements; that is the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.2).

2.4.2.1.2 Tier B: Hazardous Wastestream Quantity- Not Evaluated (NE)

The hazardous wastestream quantity for Source 1 could not be adequately determined according to HRS requirements; that is the mass of the wastestream plus the mass of any additional CERCLA pollutants and contaminants that are allocated to the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the mass of the wastestream plus the mass of any additional CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.3).

2.4.2.1.3 Tier C: Volume

The depth of the buried/backfilled ponds could not be accurately determined based on information available. Therefore, information is not sufficient to evaluate Tier C and it is not possible to adequately determine a volume for Source 1 (Ref. 1, Section 2.4.2.1.3). Source 1 has been assigned a value of 0 for the volume measure. Scoring proceeds to the evaluation of Tier D, area (Ref. 1, Section

2.4.2.1.4).

2.4.2.1.4 Tier D: Area

An approximate calculation for the area of Source 1 was performed using GIS software. The GIS software calculated the area of the polygon drawn over the footprint of the buried/backfilled ponds, visible by sparse vegetation within a wooded area, as seen on aerial photographs (Ref. 21). The GIS software calculated the area of the buried/backfilled Ponds 710 through 712 to be 81,300 ft^2 (Ref. 21, pp. 1-2). The Tier D equation for assigning a value for the area of a buried/backfilled surface impoundment is A/13 (Ref. 1, Table 2-5). Calculations for Ponds 710 through 712 are as follows:

Ponds 710 - 712: 81,300 square feet
Area of Source 1 (ft^2): 81,300
Area Assigned Value = 81,300/13
Area Assigned Value = 6,253.846

2.4.2.1.5 Source Hazardous Waste Quantity Value

Per the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) should be assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 1 Values
A	Not Evaluated
B	Not Evaluated
C	0
D	6,253.846

Source Hazardous Waste Quantity Value: 6,253.846

SOURCE DESCRIPTION

2.2 Source Characterization

Source Description: Source 2 – DAF Settling Unit (Ponds 704, 705, 706, and 707)

Source Type

The area to the southwest of the former MacMillan Refinery and west of the firewater pond contained four surface impoundments (ponds) (Source 5), covering an area of approximately 193,660 ft^2, which had historically been used by MacMillan operations to store DAF sludge (Ref. 21; Ref. 27, p. 3). DAF sludge is a listed hazardous waste due to the presence of hexavalent chromium and lead in the DAF float materials (Ref. 27, p. 3). Therefore DAF sludge is considered a K048 through K052 listed hazardous waste that is CERCLA eligible (Ref. 20, pp. 1-4; Ref. 45, p. 15). In historical reports, these surface impoundments are referred to as Ponds 704, 705, 706, and 707 (Ref. 23, p. 57, 163; Ref. 27, p. 2). These surface impoundments (ponds) were located in a series and were connected to each other by flow lines. The DAF float gravity flowed via a 6-inch line to Pond 706 where the sludge settled to the bottom of the pond. Water from Pond 706 flowed via a flow line below the surface to Pond 705 and again via a flow line to Pond 707 (Ref. 27, pp. 2, 3). Pond 704 (also called 5-acre Pond) was utilized as wastewater treatment pond that received runoff of the CERCLA wastes from Ponds 705-707 when they were full and overflowing (Ref. 10, p. 28; Ref, 23, pp. 27, 40). Pond 704 was believed to be connected to Ponds 705-707 via underground pipes and/or broken earthen levees (Ref. 43, p. 2). Together all these ponds operated as a DAF settling unit. EPA estimated that the total capacity of the ponds (Source 5) was approximately 30,000 cubic yards (Ref. 23, p. 27). In 1992, ADPC&E noted that Pond 705 contained evidence of oily staining and the berm had collapsed on the far south side allowing liquid to flow freely into Pond 707. Pond 706 had evidence of oily staining and dead vegetative growth around the pond. Pond 707's berm had also collapsed on the southwest side allowing liquid to flow freely into Pond 704 (Ref. 9, p. 24). During a 1992 EPA assessment it was noted that Pond 704 was full and had recently overflowed to Massey Creek (Ref. 23, p. 40). The DAF settling units (ponds) operated in the past without any freeboard or liner and overtopping of dikes was observed (Ref. 20, pp. 49, 77, 78, 80, 82, 83, 156, 157; Ref. 23, p. 27).

OPA and CERCLA wastes were treated at the same time within 13 separate batches, and bioremediated soils from all impoundments (OPA and CERCLA) were used to backfill the impoundments (Ref. 8, pp. 26-27; Ref. 45, pp. 5, 6). According to ADPC&E, although Ponds 704-707 were backfilled with soil that was bioremediated, it is likely that there are affected soils left in place, as reportedly the financial resources were not available at the time to meet proposed cleanup criteria (Ref. 6, p. 81; Ref. 28, pp. 1-2). Sidewall contamination remained in place, as it was outside the scope of EPA Emergency Response Branch actions (Ref. 9, p. 42). The location of the backfilled Ponds 704-707 (Source 2) is still apparent due to lack of vegetation present; however, individual ponds are no longer discernible (Ref. 6, p. 22; Ref. 22, pp. 10-12).

Source 2 is classified as the HRS source type "Buried/Backfilled Surface Impoundment" (Ref. 1, Table 2-5).

Source Location

The backfilled Ponds 704-707 (Source 2) are located on the southwest side of the facility just west and southwest of the firewater pond (Attachment A Figure A-2; Ref. 6, p. 99).

Source Containment

Release To Surface Water

The backfilled Ponds 704-707, Source 2, do not have a maintained engineered cover, no liner, and no functioning or maintained run-on control system or runoff management system (Ref. 6, p. 81; Ref. 15, p. 65; Ref. 20, p. 38). Although the ponds have been backfilled, placement of an impermeable membrane was deemed too expensive during the closeout of the ponds (Ref. 28, p. 2).

Containment Value: 10

2.4.1 Hazardous Substances

Sampling conducted in 1992 on the sludge from the pits before removal activities were conducted, had the following chromium levels detected in them. Pond 704 contained 77.9 mg/kg of chromium, Pond 705 contained 183 mg/kg of chromium, Pond 706 contained 138 mg/kg of chromium, and Pond 707 contained 97.7 mg/kg of chromium (Ref. 46, pp. 44-47; Ref. 47, p. 2).

During previous investigations, liquid waste (MW-1 and MW-5) and soil (NCI-9) samples were collected from the area of Ponds 704, 705, 706, and 707 (Source 2). During ADPC&E sampling in 1990, elevated levels of PAHs and approximately 15 gallons of oil were found in MW-1 (Ref. 6, p. 79; Ref. 11, p. 9). In 1992, EPA contractors found elevated concentrations of SVOCs naphthalene and phenol detected in samples from MW-5 (Ref. 6, p. 80). In 1996 and 1997, EPA contractors found 2 feet of waste in MW-1 and a number of PAHs, with benzo(a)pyrene detected above the EPA maximum contaminant level (Ref. 6, p. 80). As part of the CSA in 2011, ADEQ contractors found lead in liquid waste from MW-1 and hexavalent chromium in surface soil at a concentration of 1.7 mg/kg from NCI-9, above EPA Regional Screening Levels (Ref. 6, pp. 93, 99).

As part of SR sampling of MacMillan from 13 through 17 August 2012, EPA contractors collected one liquid waste sample from the location of the former ponds, Source 2 (Ref. 5, pp. 5; Ref. 22, p. 16; Ref. 25, p. 21). The sample contained two layers, with liquid waste visible on water (Ref. 22, p. 16). The sample was analyzed for TCL VOCs, TCL SVOCs, pesticides, and PCBs by the CLP SOW for Multi-Media, Multi-Concentration Organic Analysis, OLM04.2, and TAL metals with mercury by CLP SOW Multi-Media, Multi-Concentration Inorganics Analysis, ISM05.3 (Ref. 25, p. 23). TCL SVOCs were also analyzed by EPA SW 846 Method 8270 for low-level PAHs (Ref. 26, pp. 431-432). The sample was submitted to the EPA Region 6 Environmental Services Branch Laboratory, located in Houston, Texas (Ref. 5, p. 5; Ref. 26, pp. 1, 309, 431).

MW-1 was placed adjacent to and downgradient of Source 2 in 1987, as part of the closure of the impoundments and in order to monitor the contamination from the former hazardous waste management unit (Ref. 6, p. 79). Therefore samples from MW-1 are indicative of the waste present

within Source 2. Analytical evidence of the contamination associated with Source 2 located on the MacMillan site is summarized below.

Hazardous Substance	Evidence			References
	Sample ID	Concentration (mg/L)	Reporting Limit[1] (mg/L)	
EPA SR Sampling Activities – August 2012				
Chromium	MW-1-120816-21	0.6	0.09	Ref. 26, pp. 1-3, 197; Ref. 30, p. 25
Lead	MW-1-120816-21	0.6	0.09	Ref. 26, pp. 1-3, 197; Ref. 30, p. 25
Vanadium	MW-1-120816-21	1.6	0.2	Ref. 26, pp. 1-3, 197; Ref. 30, p. 25
2-Methylnaphthalene	MW-1-120816-21	3.49 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Acenaphthylene	MW-1-120816-21	2.74 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Anthracene	MW-1-120816-21	11.2 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Benzo(a)anthracene	MW-1-120816-21	9.48 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Benzo(a)pyrene	MW-1-120816-21	2.88 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Beno(k)fluoranthene	MW-1-120816-21	2.42 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Chrysene	MW-1-120816-21	14.7 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Fluoranthene	MW-1-120816-21	4.11 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Fluorene	MW-1-120816-21	6.16 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Naphthalene	MW-1-120816-21	2.63 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Phenanthrene	MW-1-120816-21	9.2 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25
Pyrene	MW-1-120816-21	32.8 J	2.29	Ref. 26, pp. 431-433, 608; Ref. 30, p. 25

Notes:
mg/kg = milligrams per kilogram = 1,000 micrograms per kilogram (µg/kg)
J Identification of analytes is acceptable; the reported value is an estimate because the samples were extracted past holding time. Concentrations should be considered minimum values (Ref. 26, p. 432). These estimated values are biased low (Ref. 26, p. 432; Ref. 50, p. 1).
[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory is adjusted for sample aliquot, sample volume, and dilutions for the analysis and meets the definition of Sample Quantitation Limit (SQL) as defined by the HRS (Ref. 1, Section 1.1; Ref. 26, pp. 3, 311; Ref. 48, pp. 1-2).

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Tier A: Hazardous Constituent Quantity - Not Evaluated (NE)

The hazardous constituent quantity for Source 2 could not be adequately determined according to HRS requirements; that is the total mass of all CERCLA hazardous substances in the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.) available to adequately calculate the total mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 2 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.2).

2.4.2.1.2 Tier B: Hazardous Wastestream Quantity - Not Evaluated (NE)

The hazardous wastestream quantity for Source 2 could not be adequately determined according to HRS requirements; that is the mass of the wastestream plus the mass of any additional CERCLA pollutants and contaminants that are allocated to the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the mass of the wastestream plus the mass of any additional CERCLA pollutants and contaminants in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source 2 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Sec. 2.4.2.1.3).

2.4.2.1.3 Tier C: Volume

The depth of the buried/backfilled ponds, Source 2, could not be accurately determined based on information available. Therefore, information is not sufficient to evaluate Tier C and it is not possible to adequately determine a volume for Source 2. Source 2 has been assigned a value of 0 for the volume measure (Ref. 1, Section 2.4.2.1.3). Scoring proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.4).

2.4.2.1.4 Tier D: Area

An approximate calculation for the area of Source 2 was performed using GIS software. The GIS software calculated the area of the polygon drawn over the footprint of the buried/backfilled Ponds 704-707, visible by sparse vegetation west and southwest of the fire water pond, as seen on aerial photographs (Ref. 21). The GIS software calculated the area of the buried/backfilled Ponds 704-707 to be 193,660 ft^2 (Ref. 21, pp. 1, 3) . The Tier D equation for assigning a value for area of a buried/backfilled surface impoundment is A/13 (Ref. 1, Table 2-5). Calculations are as follows:

Ponds 704-707 = 193,660 square feet
Area of Source 2 (ft^2): 193,660
Area Assigned Value = 193,660/13
Area Assigned Value = 14,896.923

2.4.2.1.5 Source Hazardous Waste Quantity Value

According to the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), volume (Tier C), and area (Tier D) should be assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 2 Values
A	Not Evaluated
B	Not Evaluated
C	0
D	14,896.923

Source Hazardous Waste Quantity Value 14,896.923

Other Sources Not Scored

A set of five aboveground storage tanks (ASTs) used for the storage of oil are located east of the former refinery (Ref. 6, p. 22). While MacMillan was operating, there were six ASTs at this location that had a total capacity of 20,000 gallons each (Ref. 27, p. 11). In 1992, it was observed that one of these ASTs had leaked a hard asphalt substance, and it appeared that as weather temperatures rose, this substance would liquefy and start to flow from the ASTs (Ref. 23, p. 50). These tanks were insulated with an open cell foam insulation that was covered with a corrugated metal protective skin. The metal skin was missing from several large areas of the tanks and the foam insulation was observed falling to the ground during field activities conducted by ADEQ contractors in 2011 (Ref. 6, p. 22). Currently these ASTs (tanks) are in various stages of disrepair, and some tanks have been completely or partially removed. Surface soil staining (black, petroleum hydrocarbon) is extensive in the area of the tank farm (Ref. 6, p. 87; Ref. 22, pp. 8 -10). Runoff is visible through continuous staining along the drainage ditches leading off-property (Ref. 6, p. 87, 133, 134, 140; Ref. 22, pp. 8-10).

As part of the CSA in 2011, ADEQ contractors collected surface soil samples in the vicinity of the tank farm. Diesel-range organics were detected in the vicinity of the tank farm and to the southeast (Ref. 6, p. 87).

As part of SR sampling of MacMillan from 13 through 17 August 2012, EPA contractors collected two solid waste samples from around the tank farm (Ref. 5, pp. 5; Ref. 22, pp. 10-12; Ref. 25, p. 21). The samples were analyzed for TCL VOCs, TCL SVOCs, pesticides, and PCBs by the CLP SOW for Multi-Media, Multi-Concentration Organic Analysis, OLM04.2, and TAL metals with mercury by CLP SOW Multi-Media, Multi-Concentration Inorganics Analysis, ILM05.3 (Ref. 25, p. 23). TCL SVOCs were also analyzed by EPA SW 846 Method 8270 for low-level PAHs (Ref. 26, pp.431-432). The samples were submitted to the EPA Region 6 Environmental Services Branch Laboratory, located in Houston, Texas (Ref. 5, p. 5; Ref. 26, pp. 1, 309, 431).

Analytical evidence of the contamination associated with the tanks located on the MacMillan site is summarized below.

Hazardous Substance	Evidence			References
	Sample ID	Concentration (mg/kg)	Reporting Limit[1] (mg/kg)	
EPA SR Sampling Activities – August 2012				
Benzo(a)anthracene	TS-01-03-51	0.0205 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Benzo(a)pyrene	TS-01-03-51	0.0251 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Benzo(k)fluoranthene	TS-01-03-51	0.245 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Benzo(g,h,i)perylene	TS-01-03-51	0.0703 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Chrysene	TS-01-03-51	1.34 J	0.0517	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Dibenz(a,h)anthracene	TS-01-03-51	0.0187 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Indeno(1,2,3-cd)pyrene	TS-01-03-51	0.0196 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Phenanthrene	TS-01-03-51	0.0216 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8
Pyrene	TS-01-03-51	0.205 J	0.0129	Ref. 26, pp. 431-433, 530; Ref. 30, p. 8

Hazardous Substance	Evidence			References
	Sample ID	Concentration (mg/kg)	Reporting Limit[1] (mg/kg)	
Arsenic	TS-01-03-51	1.3	0.5	Ref. 26, pp. 1-3, 105; Ref. 30, p. 8
Chromium	TS-01-03-51	1.3	1.0	Ref. 26, pp. 1-3, 109; Ref. 30, p. 8
Lead	TS-01-03-51	10.0	0.5	Ref. 26, pp. 1-3, 109; Ref. 30, p. 8
Manganese	TS-01-03-51	25.4 J*	0.5	Ref. 26, pp. 1-3, 109; Ref. 30, p. 8
Vanadium	TS-01-03-51	3.0	2.1	Ref. 26, pp. 1-3, 109; Ref. 30, p. 8
Zinc	TS-01-03-51	13.7	2.1	Ref. 26, pp. 1-3, 109; Ref. 30, p. 8
Benzo(a)anthracene	TS-02-03-51	0.0791 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Benzo(a)pyrene	TS-02-03-51	0.0729 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Benzo(k)fluoranthene	TS-02-03-51	0.298 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Benzo(g,h,i)perylene	TS-02-03-51	0.0957 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Chrysene	TS-02-03-51	1.38 J	0.0523	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Dibenz(a,h)anthracene	TS-02-03-51	0.0269 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Indeno(1,2,3-cd)pyrene	TS-02-03-51	0.0332 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
2-Methylnaphthalene	TS-02-03-51	0.0163 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Naphthalene	TS-02-03-51	0.0141 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Phenanthrene	TS-02-03-51	0.0304 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Pyrene	TS-02-03-51	0.200 J	0.0131	Ref. 26, pp. 431-433, 534; Ref. 30, p. 8
Arsenic	TS-02-03-51	1.8	0.5	Ref. 26, pp. 1-3, 113; Ref. 30, p. 8
Chromium	TS-02-03-51	4.5	1.0	Ref. 26, pp. 1-3, 113; Ref. 30, p. 8
Lead	TS-02-03-51	9.3	0.5	Ref. 26, pp. 1-3, 113; Ref. 30, p. 8
Manganese	TS-02-03-51	12.9	0.5	Ref. 26, pp. 1-3, 113; Ref. 30, p. 8
Mercury	TS-02-03-51	0.10	0.072	Ref. 26, pp. 1-3, 114; Ref. 30, p. 8
Vanadium	TS-02-03-51	11.1	1.9	Ref. 26, pp. 1-3, 113; Ref. 30, p. 8
Zinc	TS-02-03-51	8.3	1.9	Ref. 26, pp. 1-3, 113; Ref. 30, p. 8

Notes:
mg/kg = milligrams per kilogram = 1,000 micrograms per kilogram (µg/kg)

J Identification of analytes is acceptable; the reported value is an estimate because the samples were extracted past holding time. Concentrations should be considered minimum values (EPA Region 6 data, p. 432). These estimated values are biased low (Ref. 26, p. 432; Ref. 50, p. 1).

J* For Identification of analyte is acceptable; the reported value is an estimate due to outlying quality control parameters (Ref. 26, pp. 3, 695). These estimated values are biased low as the samples were extracted out of the hold time (Ref. 26, p. 432; Ref. 50, p. 1).

[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory is adjusted for sample aliquot, sample volume, and dilutions for the analysis and meets the definition of Sample Quantitation Limit (SQL) as defined by the HRS (Ref. 1, Section 1.1; Ref. 26, pp. 3, 311; Ref. 48, pp. 1-2).

SITE SUMMARY OF SOURCE DESCRIPTIONS

Source No.	Source Hazardous Waste Quantity Value	Containment Factor Value			
		Ground Water	Surface Water	Gas	Air Particulate
1	6,253.846	NE	10	NE	NE
2	14,896.923	NE	10	NE	NE
TOTAL	21,150.769				

NE = Not Evaluated

3.0 GROUND WATER MIGRATION PATHWAY SCORE - NOT SCORED

The ground water migration pathway will not be scored because it is not expected to contribute significantly to the Site score. The Site score already exceeds 28.50 based only on the evaluation of the surface water pathway.

Ground water samples were collected during the sampling events conducted by ADEQ in 1987 and 1990; by EPA contractors in 1994, 1996, and 1997; by ADEQ contractors during the 2011 CSA conducted, and by EPA contractors during the 2012 SR. During these events, elevated levels of PAHs were detected in several wells located throughout the facility (Ref. 6, pp. 79, 80, 94, 144). Total chromium was detected in monitoring wells located on the east side of the facility in 2011, as well as total lead in several locations throughout the facility (Ref. 6, p. 86). Hexavalent chromium and lead were also detected in a monitoring well (NCI-3) located on the east side of the Site in 2012 (Ref. 5, p. 14). During the 2012 EPA SR, passive soil gas (PSG) samples were collected at the leading edge of historical plume boundary which was identified during the 2011 CSA sampling event (Ref. 5, pp. 4; 20; Ref. 6, pp. 94-98). The samples were analyzed for VOCs. Only one TPH value, slightly above detection limits was detected (Ref. 5, p. 18). Results indicated that the plume's predominant direction is away from the school.

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1 General Considerations

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

The hazardous substance migration path includes both the overland and the in-water segment that hazardous substances would take as they migrate away from sources at the site (Ref. 1, Section 4.1.1.1). Hazardous substance migration paths overland and in-water segments for Sources 1 through 5 are described in the following text. The surface water pathway is presented on Figures A-3 and A-4.

Overland Segments

Topography of the MacMillan Ring Free Oil property slopes to the east and to the south, as described in the paragraphs below. The eastern slope that guides source contamination to the probable points of entry on the eastern side of the property is 5%, or 11.28º (Ref. 3, p. 1; Ref. 40, p. 1).

Source 1 – Buried/Backfilled Ponds 710, 711, and 712
A Probable Point of Entry (PPE), referred to as PPE1 (location DD-01), exists downgradient and to the east of the backfilled Pond 712 (Source 1) (Ref. 5, p. 13; Ref. 30, p. 9; Ref. 39, pp. 1-2). Surface water runoff emanating from the barren area of the former pond flows east, following the natural topography approximately 40 feet east toward Hayes Creek, entering the creek at DD-01 (PPE1) (Ref. 5, p. 13; Ref. 30, p. 9; Ref. 39, pp. 1-2). On the southeast end of Source 1, surface water runoff flows east/southeast and flows through a pipe located at DD-05 which abuts the former pond (Ref. 22, p. 15). From the pipe, flow continues south along a drainage ditch for approximately 95 feet before entering the loop to Hayes Creek at DD-02 (PPE2) (Ref. 39, pp. 1, 2; Ref. 42, p. 1).

From Pond 711 of Source 1, drainage occurs to the southeast and enters the adjacent wetland, contiguous to Hayes Creek, at PPE5 with a minimal (>0) overland flow distance (Ref. 5, p. 13; Ref. 22, p. 3; Ref. 30, p. 9; Ref. 39, pp. 1-2).

From Pond 710 of Source 1, drainage occurs to the southeast and enters the adjacent wetland contiguous to Hayes Creek at PPE4 with a minimal (>0) overland flow distance (Ref. 22, p. 3; Ref. 39, pp. 1-2).

Source 2 – Buried/Backfilled Ponds 704-707
Runoff/overflow emanating from the backfilled Ponds 704-707 historically and currently surface flows south through drainage ditches approximately 2,500 feet to Massey Creek via PPE6 (Ref. 3, p. 1; Ref. 6, pp. 26, 44; Ref. 15, pp. 64, 68; Ref. 39, pp. 1, 3). The majority of wastes emanating from Source 2 is subsurface as evident through the wastes found in MW-1, and discharges through active seeps present throughout the property (Ref. 6, pp. 12, 22, 123; Ref. 15, pp. 14, 15, 17-21; Ref. 22, p. 16). Overland flow from Source 2 also follows surface topography gradient to the north-northeast toward Hayes Creek for approximately 1,000 feet to an active seep (RD-02) (Ref. 6, pp. 13, 43). The active seep was sampled during the 2012 SR activities (RD-02) (Ref. 22, p. 9). From this location overland flow continues north approximately 175 feet along the drainage ditch located on the eastern side of the railroad spurs, until it intercepts a corrugated culvert (located at OP-01). The corrugated culvert

continues east under the railroad tracks and a dirt road another 105 feet and discharges through a second outfall pipe (OP-02) (Ref. 5, p.13; Ref. 22, p. 12; Ref. 30, pp. 3, 10; Ref. 39, pp. 1-2). From here, the overland flow travels through a ditch approximately 150 feet east and empties into a man-made pond, which currently serves as wetland habitat, via PPE3 (Ref. 5, p. 13; Ref. 16, pp. 1-13; Ref. 22, p. 13; Ref. 30, p. 10; Ref. 39, pp. 1-2).

The outer banks of Hayes Creek are located in Federal Emergency Management Association (FEMA) Flood Zone A. Flood Zone A is subject to inundation by the 1% annual chance of flood (Ref. 24, pp. 1-3). This increases the chances that chemicals emanating from the MacMillan Site will be carried downstream. In addition, the contiguous wetland and Hayes Creek constitutes the beginning of the in-water segment for the surface water pathway.

In-Water Segments

The in-water segment begins at the PPE to an eligible surface water body as defined in the HRS (Ref. 1, Sec. 4.1.1). Eligible surface water bodies that have been determined to be part of the in-water segment for the MacMillan Site include the wetland contiguous to Hayes Creek, Hayes Creek, Massey Creek, Flat Creek, Haynes Creek, Smackover Creek, and the Ouachita River (Attachment A, Figure A-4; Ref. 3, pp. 1-3; Ref. 30, pp. 1, 2; Ref. 41, pp. 1-2). All of the surface water bodies within the in-water segment are perennial and, therefore, eligible for HRS scoring (Ref. 1, Sec. 4.0.2; Ref. 42, p. 1; Ref. 49, pp. 1-3)

The Target Distance Limit (TDL) is defined as being 15 miles from the farthest downstream PPE in the in-water segment section (Ref. 1, Sec. 4.1.1.2). The TDL of the surface water flow path is presented in Attachment A, Figure A-4 and is described in the following paragraphs.

Drainage from Source 1 enters Hayes Creek at locations DD-01 (PPE1) and DD-02 (PPE2). Drainage on the south end of Source 1 enters the wetland contiguous to Hayes Creek at PPE4 and PPE5. Drainage from Source 2 enters Massey Creek from PPE6 (Attachment A, Figure A-3; Ref. 5, p. 13; Ref. 15, p. 68; Ref. 39, pp. 1, 2).

PPE2 and PPE6 are the farthest downstream PPEs. From PPE2, Hayes Creek flows for 1.07 miles before its confluence with Flat Creek. From PPE6, Massey Creek flows for 2.65 miles before its confluence with Flat Creek. Flat Creek flows eastward for 1.86 miles before flowing into Haynes Creek. Haynes Creek meanders northeast for 5.46 miles before joining Smackover Creek. Smackover Creek meanders 4.48 miles before flowing into the Ouachita River. The in-water segment of the surface water pathway continues for 0.15 miles from PPE6 and 2.13 miles from PPE2 in the Ouachita River until the pathway extent reaches 15 miles, just northwest of Babb Lake (Attachment A, Figure A-4; Ref. 3, p. 1-3; Ref. 41, pp. 1, 2).

4.1.2.1 LIKELIHOOD OF RELEASE

4.1.2.1.1 Observed Release

Direct Observation

Observed Release is established by direct observation. Evidence of sources flooding with material containing hazardous substances in direct contact with the surface water exists. Several overflows to Hayes Creek from the DAF impoundments and other impoundments have historically occurred (Ref. 8, pp. 5-6, 9; Ref. 9, pp. 1-2, 6). During the 1980s, several overflows to Hayes Creek from the ponds were documented (Ref. 8, pp. 5-6, 9). In December 1982 and January 1983, floods in the area caused oily materials containing hazardous substances to release from the ponds and cover approximately 150 to 200 acres of Ouachita River bottom between Calion and Campanolle Landing (Ref. 8, p. 14; Ref. 9, pp. 1-2, 6).

On 6 September 1990, during an ADPC&E inspection of the facility, the inspector observed unpermitted discharge of pond fluids to an unnamed creek (Hayes Creek) (Ref. 9, p. 10).

Between 28 May and 20 June 1992, cleanup of affected vegetation along Hayes Creek took place. Cleanup involved placing numerous sections of sorbent boom in the creek to contain free floating oil and the collection of oily contaminated materials from the creek banks. Due to the large amount of oily soaked vegetation along the creek bed, a controlled burn took place. The oily soaked materials that were not suitable for burning were placed in roll-off boxes for disposal (Ref. 8, p. 11).

On 13 July 1994, ADPC&E representatives found evidence of a release from the ponds located east of the railroad tracks. Visual staining was observed on the berms of the ponds and along the banks of Hayes Creek (Ref. 9, p. 37).

Chemical Analysis

As well as an observed release by direct observation, an observed release by chemical analysis is established. In 1985, during an inspection, EPA contractors sampled the east side of the property (Ref. 20, pp. 11, 19, 20) . Analytical results detected elevated concentrations of organics (mainly unknown compounds) as well as lead from the Pond 712 bank, the pathway between the pond and Hayes Creek, and from within Hayes Creek (Ref. 20, p. 11).

During the August 2012 SR sampling activities conducted by EPA contractors, surface water and sediment samples collected from within the surface water pathway demonstrated elevated concentrations of hazardous substances (Ref. 5, p. 4). For the purpose of this report, only the sediment samples are being presented, as the sediment samples alone provide sufficient evidence to establish an observed release. Two sediment samples were collected from the wetland contiguous to Hayes Creek and twelve sediment samples were collected from within Hayes Creek (Ref. 5, p. 4). Sample locations are depicted in Figure A-5 of Attachment A.

Background Concentrations

A background sediment sample was collected from Hayes Creek (BG-01) approximately 1,000 feet upstream and upgradient of the site (Attachment A, Figure A-5; Ref. 25, p. 4) . The background sediment sample collected from Hayes Creek is compared to site-related sediment samples collected from the wetland contiguous to Hayes Creek and Hayes Creek in order to illustrate an observed release from the site to the surface water pathway can be established (Ref. 5, p. 4; Ref. 25, pp. 13, 21).

The background sediment sample was collected on 16 August 2012 by EPA contractors. The sediment sample was collected from 0 to 2 inches below ground surface (bgs) with disposable plastic scoops then transferred directly to the appropriate sample containers. The sample was collected from within the creek where sediments had accumulated (Ref. 5, p. 4). Once collected, the sediment sample bottles were placed on ice until shipping (Ref. 5, p. 4; Ref. 25, p. 20). The background sample and the samples collected to demonstrate the presence of contamination in the overland flow path and to demonstrate an observed release were all collected during the same time frame during the same sampling event (Ref. 5, p. 4). The samples were collected by the same field team during the same sampling event, following the same sample collection protocols and methodologies. The background sample was collected from a similar location (within Hayes Creek), was from similar media (the sediment/soil type at Hayes Creek is similar to the eastern end of the wetland), same depth, used the same sampling methods, preservation, and handling and were all collected during the same weather conditions as the observed release samples (Ref. 5, p. 4; Ref. 16, pp. 2, 6; Ref. 30, pp. 4-13).

Sediment samples were shipped via Federal Express to the EPA Region 6 Laboratory located in Houston, Texas, for VOCs, SVOCs, pesticides, PCBs, TAL metals and mercury analysis and to Test America Laboratories, Inc. located in Savannah, Georgia, for hexavalent chromium analysis. The samples were analyzed for VOCs , SVOCs, pesticides, and PCBs by CLP COW OLM04.2, for TAL metals and mercury by CLP SOW ISM05.3, and hexavalent chromium by EPA Method SW846 7196A (Ref. 5, p. 5; Ref. 25, p. 23; Ref. 26, pp. 279-306, 401-428, 667-694).

EPA SR Sampling Event - Background Sample Description
August 2012

Station Location (Sample ID)	Sample Location	Sample Date (Military Time)	Reference
Sediment			
BG-01 (BG-01-03-51)	Hayes Creek upstream of the MacMillan Site sources.	08/16/2012 (0710)	Ref. 25, p. 21; Ref. 26, p 299; Ref. 30, p. 11; Attachment A, Figure A-5

EPA SR Sampling Event - Background Sample Concentrations
August 2012

Summary of MacMillan Designated Background Levels				
Hazardous Substance	**Evidence**			**Reference**
	Station Location/ Sample ID	**Concentration mg/kg**	**RL[1] mg/kg**	
Sediment – Hayes Creek				
2-Methylnaphthalene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Anthracene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Benzo(a)anthracene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Benzo(a)pyrene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Benzo(k)fluoranthene	BG-01 / BG-01-03-51	0.0073 J[2] (0.073)	0.0058	Ref. 26, pp. 431-433, 569
Benzo(g,h,i)perylene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Chrysene	BG-01 / BG-01-03-51	0.105 J[2] (1.05)	0.0058	Ref. 26, pp. 431-433, 569
Fluoranthene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Indeno(1,2,3-cd)pyrene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Naphthalene	BG-01 / BG-01-03-51	0.0073 J[2] (0.073)	0.0058	Ref. 26, pp. 431-433, 569
Phenanthrene	BG-01 / BG-01-03-51	0.0058 U	0.0058	Ref. 26, pp. 431-433, 569
Pyrene	BG-01 / BG-01-03-51	0.0081 J[2] (0.096066)	0.0058	Ref. 26, pp. 431-433, 569
Arsenic	BG-01 / BG-01-03-51	0.5 U	0.6	Ref. 26, pp. 1-3, 153
Cadmium	BG-01 / BG-01-03-51	1.6	0.6	Ref. 26, pp. 1-3, 153
Chromium	BG-01 / BG-01-03-51	1.2 U	1.2	Ref. 26, pp. 1-3, 153
Chromium (VI)	BG-01 / BG-01-03-51	1.5 U	1.5	Ref. 19, p. 6
Lead	BG-01 / BG-01-03-51	8.8	0.6	Ref. 26, pp. 1-3, 153
Manganese	BG-01 / BG-01-03-51	2.5	0.6	Ref. 26, pp. 1-3, 153
Mercury	BG-01 / BG-01-03-51	0.066 U	0.066	Ref. 26, pp. 1-3, 154
Vanadium	BG-01 / BG-01-03-51	2.7	2.4	Ref. 26, pp. 1-3, 153
Zinc	BG-01 / BG-01-03-51	10.5	2.4	Ref. 26, pp. 1-3, 153

Notes:

mg/kg = milligrams per kilogram = 1,000 micrograms per kilogram (µg/kg)

[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory are detection limits which have been adjusted for sample aliquot, sample volume, and dilutions for the analysis and meet the HRS definition of SQL (Ref. 1, Section 1.1, Table 2-3; Ref. 24, p. 4; Ref. 26, pp. 3, 433; Ref. 48, pp. 1-2).

[2] Values that have been adjusted according to the EPA Fact Sheet (Ref. 29) are listed in parentheses.

U Not detected at reported quantitation limit (Ref. 26, p. 307).

J Identification of analyte is acceptable; the reported value is an estimate because the samples were extracted past holding time. Concentrations should be considered minimum values (Ref. 26, p. 432). These estimated values are biased low (Ref. 26, p. 432; Ref. 50, p. 1).

Observed Release Samples

Observed release criteria are met when the hazardous substance is attributable to a release from the Site, its concentration exceeds the SQL (including the background SQL), and is at least three times greater than the background concentration when the background concentration equals or exceeds its SQL (Ref. 1, Table 2-3).

Sampling locations with hazardous substances meeting observed release criteria are presented below.

EPA SR Sampling Event – August 2012

Station Location (Sample ID)	Sample Location	Sample Date (Military Time)	Reference
Hayes Creek			
PPE-01 (PPE-01-03-51)	Where loop of Hayes Creek enters main branch of Hayes Creek on the north.	08/14/2012 (1310)	Ref. 25, p.21; Ref. 26, pp. 285, 288; Ref. 30, p.6
PPE-02 (PPE-02-03-51)	Where loop of Hayes Creek enters main branch of Hayes Creek on the south.	08/14/2012 (1320)	Ref. 25, p.21; Ref. 26, pp. 292, 298 Ref. 30, p. 7
PPE-04 (DD-01-03-51)	Northern-most PPE at Hayes Creek in a section that runs adjacent to former Pond 712.	08/14/2012 (0830)	Ref. 25, p.22; Ref. 26, pp. 279,288; Ref. 30, pp. 9, 5
SW-01 (SED-01-03-51)	Within Hayes Creek between north and southern sections of loop.	08/14/2012 (1050)	Ref. 25, p.21; Ref. 26, pp. 279, 288, 291; Ref. 30, p. 6
SW-02 (SED-02-03-51)	Within Hayes Creek approximately 250 feet downstream of PPE-02.	08/14/2012 (1340)	Ref. 25, p.21; Ref. 26, pp. 674, 676; Ref. 30, p. 6
SW-03 (SED-03-03-51)	Within Hayes Creek approximately 100 feet downstream of SW-02.	08/14/2012 (1402)	Ref. 25, p.21; Ref. 26, pp. 675, 676; Ref. 30, p. 7
SW-04 (SED-04-03-51)	Within Hayes Creek approximately 500 feet downstream of SW-03.	08/16/2012 (0820)	Ref. 25, p.21; Ref. 26, pp. 688, 689; Ref. 30, pp. 11, 12
SW-05 (SED-05-03-51)	Within Hayes Creek approximately 100 feet downstream of SW-04.	08/16/2012 (0835)	Ref. 25, p.21; Ref. 26, pp. 688, 690; Ref. 30, pp. 11, 12
DD-02 (DD-03-03-51)	Within loop of Hayes Creek, adjacent to wetland area and old weir system and the southernmost PPE of Source 1.	08/14/2012 (0900)	Ref. 25, p. 22; Ref. 30, p. 5; Attachment A, Figure A-5
DD-03 (DD-04-03-51)	Within loop of Hayes Creek, located just downstream of old weir system.	08/14/2012 (0920)	Ref. 25, p. 22; Ref. 30, p. 5; Attachment A, Figure A-5
DD-04 (DD-02-03-51) Field duplicate (DD-04-03-52)	Within loop of Hayes Creek, located on south end before entering the main branch of Hayes Creek.	08/14/2012 (1030)	Ref. 25, p. 22; Ref. 30, p. 6 ; Attachment A, Figure A-5
Wetland Contiguous to Hayes Creek			
PPE-03 (PPE-03-03-51)	PPE3 into wetland area.	08/15/2012 (1245)	Ref. 25, p.21; Ref. 26, pp. 294, 298; Ref. 30, p. 10
WA-01 (WA-01-03-51)	Within wetland area.	08/15/2012 (1255)	Ref. 25, p.21; Ref. 26, pp. 294, 682, 686; Ref. 30, p. 10

The sediment samples were collected on 14 through 18 August 2012 by EPA contractors. The sediment samples were collected with disposable plastic scoops and transferred to an appropriate sample container. The samples were collected from 0 to 2 inches bgs from locations within the creek

where sediments had accumulated, such as bends in the creek (Ref. 5, p. 4; Ref. 25, p. 16). Once collected, the sediment sample bottles were placed on ice until shipping (Ref. 25, p. 18).

Sediment samples were delivered via Federal Express to the EPA Region 6 Environmental Services Branch Laboratory for analysis of VOCs, SVOCs, Pesticides, PCBs, and metals with mercury. Sediment samples for analysis of hexavalent chromium were shipped via Federal Express to Test America Laboratories, Inc. located in Savannah, Georgia. The samples were analyzed for VOCs, SVOCs, pesticides, and PCBs by CLP OLM04.2, for TAL metals and mercury by CLP ILM01.2, and for hexavalent chromium by EPA SW846 Method 7196A (Ref. 5, p. 5; Ref. 25, p. 23; Ref. 26, pp. 279-306, 401-428, 667-694).

EPA SR Sampling Event – August 2012
Sediment Samples – Hayes Creek

Station Location (Sample ID)	Hazardous Substance	Concentration mg/kg	RL[1] mg/kg	Reference
PPE-01 (PPE-01-03-51)	Arsenic	0.80	0.50	Ref. 5, p.26; Ref. 26, pp. 1-3, 57
	Chromium	3.4	1.10	Ref. 5, p.26; Ref. 26, pp. 1-3, 57
	Chromium (VI)	2.3	1.3	Ref. 5, p.26; Ref. 19, p. 6
	Manganese	122	0.50	Ref. 5, p.26; Ref. 26, pp. 1-3, 57
	Vanadium	12.0	2.1	Ref. 5, p.26; Ref. 26, pp. 1-3, 57
PPE-02 (PPE-02-03-51)	Anthracene	0.0249 J	0.0244	Ref. 5, p.27; Ref. 26, pp. 431-433, 510
	Benzo(a)anthracene	0.0975 J	0.0244	Ref. 5, p.27; Ref. 26, pp. 431-433, 510
	Benzo(a)pyrene	0.044 J	0.0244	Ref. 5, p.27; Ref. 26, pp. 431-433, 510
	Benzo(g,h,i)perylene	0.0417 J	0.0244	Ref. 5, p.27; Ref. 26, pp. 431-433, 510
	Fluoranthene	0.0381 J	0.0244	Ref. 5, p.27; Ref. 26, pp. 431-433, 510
	2-Methylnaphthalene	0.0319 J	0.0244	Ref. 5, p.27; Ref. 26, pp. 431-433, 510
	Phenanthrene	0.0402 J	0.0244	Ref. 5, p.27; Ref. 26, pp. 431-433, 510
	Arsenic	0.90	0.6	Ref. 5, p.27; Ref. 26, pp. 1-3, 90
	Chromium	2.6	1.2	Ref. 5, p.27; Ref. 26, pp. 1-3, 89
	Manganese	48.7	0.6	Ref. 5, p.27; Ref. 26, pp. 1-3, 89
	Vanadium	10.4	2.4	Ref. 5, p.27; Ref. 26, pp. 1-3, 89
PPE-04 (DD-01-03-51)	Benzo(a)anthracene	0.0116 J	0.0097	Ref. 5, p.29; Ref. 26, pp. 431-433, 440
	Benzo(a)pyrene	0.0114 J	0.0097	Ref. 5, p.29; Ref. 26, pp. 431-433, 440
	Benzo(g,h,i)perylene	0.0146 J	0.0097	Ref. 5, p.29; Ref. 26, pp. 431-433, 440
	Arsenic	1.1	1.1	Ref. 5, p.28; Ref. 26, pp. 1-3, 13
	Chromium	3.4	2.1	Ref. 5, p.28; Ref. 26, pp. 1-3, 13
	Lead	128	1.1	Ref. 5, p.28; Ref. 26, pp. 1-3, 13
	Manganese	80.9	1.1	Ref. 5, p.28; Ref. 26, pp. 1-3, 13
	Vanadium	8.6	4.2	Ref. 5, p.28; Ref. 26, pp. 1-3, 13
	Zinc	59.0	4.2	Ref. 5, p.28; Ref. 26, pp. 1-3, 13
SW-01 (SED-01-03-51)	Chromium	3.1	1.2	Ref. 5, p.28; Ref. 26, pp. 1-3, 85
	Manganese	55.1	0.6	Ref. 5, p.28; Ref. 26, pp. 1-3, 85
SW-02 (SED-02-03-51)	Anthracene	0.530 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Benzo(a)anthracene	1.01 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Benzo(a)pyrene	0.433 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Benzo(k)fluoranthene	0.422 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Benzo(g,h,i)perylene	0.368 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Chrysene	1.80 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490

Station Location (Sample ID)	Hazardous Substance	Concentration mg/kg	RL[1] mg/kg	Reference
	Fluoranthene	0.567 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Indeno(1,2,3-c,d)pyrene	0.134 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	2-Methylnaphthalene	0.215 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Phenanthrene	1.53 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Pyrene	2.02 J	0.134	Ref. 5, p.30; Ref. 26, pp. 431-433, 490
	Arsenic	0.800	0.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 61
	Chromium	3.20	1.3	Ref. 5, p.30; Ref. 26, pp. 1-3, 61
	Manganese	23.3	0.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 61
	Mercury	0.132	0.059	Ref. 5, p.30; Ref. 26, pp. 1-3, 62
	Vanadium	8.80	2.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 61
	Zinc	42.8	2.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 61
SW-03 (SED-03-03-51)	Anthracene	0.0264 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Benzo(a)anthracene	0.110 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Benzo(a)pyrene	0.0901 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Benzo(k)fluoranthene	0.147 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Benzo(g,h,i)perylene	0.104 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Chrysene	0.476 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Fluoranthene	0.0231 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Indeno(1,2,3-c,d)pyrene	0.0325 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	2-Methylnaphthalene	0.0528 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Naphthalene	0.0489 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Phenanthrene	0.0489 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Pyrene	0.283 J	0.0157	Ref. 5, p.31; Ref. 26, pp. 431-433, 497
	Arsenic	0.700	0.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 69
	Chromium	2.30	1.3	Ref. 5, p.30; Ref. 26, pp. 1-3, 69
	Lead	37.8	0.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 69
	Manganese	24.4	0.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 69
	Mercury	0.083	0.06	Ref. 5, p.30; Ref. 26, pp. 1-3, 70
	Zinc	42.8	2.7	Ref. 5, p.30; Ref. 26, pp. 1-3, 69
SW-04 (SED-04-03-51)	Arsenic	1.10	0.6	Ref. 5, p.30; Ref. 26, pp. 1-3, 157
	Chromium	2.50	1.2	Ref. 5, p.30; Ref. 26, pp. 1-3, 157
SW-04 (SED-04-03-51)	Manganese	32.3	0.6	Ref. 5, p.30; Ref. 26, pp. 1-3, 157
	Vanadium	11.8	2.4	Ref. 5, p.30; Ref. 26, pp. 1-3, 157
SW-05 (SED-05-03-51)	Anthracene	0.00605 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Benzo(a)anthracene	0.0286 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Benzo(a)pyrene	0.0256 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Benzo(k)fluoranthene	0.0329 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Benzo(g,h,i)perylene	0.0145 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Chrysene	0.0905 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	2-Methylnaphthalene	0.0128 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Naphthalene	0.0153 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Phenanthrene	0.0118 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580
	Pyrene	0.0761 J	0.0055	Ref. 5, p.31; Ref. 26, pp. 431-433, 580

Station Location (Sample ID)	Hazardous Substance	Concentration mg/kg	RL[1] mg/kg	Reference
	Manganese	12.6	0.6	Ref. 5, p.30; Ref. 26, pp. 1-3, 165
DD-02 (DD-02-03-51)	Arsenic	4.5	1.1	Ref. 5, p. 19; Ref. 26, pp. 1-3, 33
	Chromium	13.6	2.3	Ref. 5, p. 19; Ref. 26, pp. 1-3, 33
	Manganese	90.0	1.1	Ref. 5, p. 19; Ref. 26, pp. 1-3, 33
	Mercury	0.224	0.099	Ref. 5, p. 19; Ref. 26, pp. 1-3, 33
	Vanadium	33.9	4.6	Ref. 5, p. 19; Ref. 26, pp. 1-3, 33
	Zinc	100	4.6	Ref. 5, p. 19; Ref. 26, pp. 1-3, 33
	2-Methylnaphthalene	0.014 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 466
	Benzo(a)anthracene	0.0312 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 466
	Benzo(a)pyrene	0.0357 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 466
	Benzo(g,h,i)perylene	0.0232 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 466
	Fluoranthene	0.0215 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 466
	Indeno(1,2,3-c,d)pyrene	0.0141 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 466
	Phenanthrene	0.0162 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 466
DD-03 (DD-03-03-51)	Arsenic	2.8	1.5	Ref. 5, p. 19; Ref. 26, pp. 1-3, 41
	Chromium	7.3	3.1	Ref. 5, p. 19; Ref. 26, pp. 1-3, 41
	Manganese	121	1.5	Ref. 5, p. 19; Ref. 26, pp. 1-3, 41
	Mercury	0.160	0.141	Ref. 5, p. 19; Ref. 26, pp. 1-3, 42
	Vanadium	19.3	6.1	Ref. 5, p. 19; Ref. 26, pp. 1-3, 41
	Zinc	148	6.1	Ref. 5, p. 19; Ref. 26, pp. 1-3, 41
	Benzo(a)anthracene	0.0362 J	0.0348	Ref. 5, p. 19; Ref. 26, pp. 431-433, 473
	Benzo(g,h,i)perylene	0.0430 J	0.0348	Ref. 5, p. 19; Ref. 26, pp. 431-433, 473
DD-04 (DD-04-03-51)	Chromium	1.7	1.2	Ref. 5, p. 19; Ref. 26, pp. 1-3, 49
	Manganese	14.9	0.6	Ref. 5, p. 19; Ref. 26, pp. 1-3, 49
	Mercury	0.076	0.058	Ref. 5, p. 19; Ref. 26, pp. 1-3, 50
	Benzo(a)anthracene	0.0259 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 480
	Benzo(a)pyrene	0.0352 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 480
	Benzo(g,h,i)perylene	0.0456 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 480
	Fluoranthene	0.0386 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 480
	Phenanthrene	0.0391 J	0.0135	Ref. 5, p. 19; Ref. 26, pp. 431-433, 480
DD-04 (DD-04-03-52)	Arsenic	0.7	0.6	Ref. 5, p. 19; Ref. 26, pp. 1-3, 21
	Chromium	2.2	1.2	Ref. 5, p. 19; Ref. 26, pp. 1-3, 21
	Manganese	23.4	0.6	Ref. 5, p. 19; Ref. 26, pp. 1-3, 21
	Zinc	48.6	2.4	Ref. 5, p. 19; Ref. 26, pp. 1-3, 21
	Benzo(a)anthracene	0.0198 J	0.0056	Ref. 5, p. 19; Ref. 26, pp. 431-433, 453
	Benzo(a)pyrene	0.0284 J	0.0056	Ref. 5, p. 19; Ref. 26, pp. 431-433, 453
	Benzo(g,h,i)perylene	0.0343 J	0.0056	Ref. 5, p. 19; Ref. 26, pp. 431-433, 453
	Fluoranthene	0.0124 J	0.0056	Ref. 5, p. 19; Ref. 26, pp. 431-433, 453
	Indeno(1,2,3-cd)pyrene	0.0095 J	0.0056	Ref. 5, p. 19; Ref. 26, pp. 431-433, 453
	2-Methylnaphthalene	0.0117 J	0.0056	Ref. 5, p. 19; Ref. 26, pp. 431-433, 453
	Phenanthrene	0.0143 J	0.0056	Ref. 5, p. 19; Ref. 26, pp. 431-433, 453

Notes:
mg/kg = milligrams per kilogram = 1,000 micrograms per kilogram (µg/kg)

[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory are detection limits which have been adjusted for sample aliquot, sample volume, and dilutions for the analysis and meet the HRS definition of SQL (Ref. 1, Section 1.1, Table 2-3; Ref. 24, p. 4; Ref. 26, pp. 3, 311; Ref. 48, pp. 1-2).

J Identification of analyte is acceptable; the reported value is an estimate because the samples were extracted past holding time. Concentrations should be considered minimum values (Ref. 26, p. 432). The estimated values are biased low (Ref. 26, p. 432; Ref. 50, p. 1).

EPA SR Sampling Event – August 2012
Sediment Samples – Wetland Contiguous to Hayes Creek

Station Location (Sample ID)	Hazardous Substance	Concentration mg/kg	RL[1] mg/kg	Reference
PPE-03 (PPE-03-03-51)	Benzo(a)anthracene	0.0229 J	0.0075	Ref. 5, p.29; Ref. 26, pp. 431-433, 542
	Benzo(a)pyrene	0.022 J	0.0075	Ref. 5, p.29; Ref. 26, pp. 431-433, 542
	Benzo(g,h,i)perylene	0.0141 J	0.0075	Ref. 5, p.29; Ref. 26, pp. 431-433, 542
	Fluoranthene	0.016 J	0.0075	Ref. 5, p.29; Ref. 26, pp. 431-433, 542
	Indeno(1,2,3-cd)pyrene	0.00991 J	0.0075	Ref. 5, p.29; Ref. 26, pp. 431-433, 542
	2-Methylnaphthalene	0.00828 J	0.0075	Ref. 5, p.29; Ref. 26, pp. 431-433, 542
	Phenanthrene	0.0214 J	0.0075	Ref. 5, p.29; Ref. 26, pp. 431-433, 542
	Arsenic	1.6	0.6	Ref. 5, p.28; Ref. 26, pp. 1-3, 121
	Chromium	4.2	1.1	Ref. 5, p.28; Ref. 26, pp. 1-3, 121
	Manganese	36.2	0.6	Ref. 5, p.28; Ref. 26, pp. 1-3, 121
	Mercury	0.087	0.054	Ref. 5, p.28; Ref. 26, pp. 1-3, 121
	Vanadium	11.0	2.2	Ref. 5, p.28; Ref. 26, pp. 1-3, 121
WA-01 (WA-01-03-51)	Arsenic	1.3	0.5	Ref. 5, p.32; Ref. 26, pp.1-3, 137
	Chromium	3.9	1.0	Ref. 5, p.32; Ref. 26, pp.1-3, 137
	Manganese	47.9	15.6	Ref. 5, p.32; Ref. 26, pp.1-3, 137

Notes:
mg/kg = milligrams per kilogram = 1,000 micrograms per kilogram (µg/kg)

[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory are detection limits which have been adjusted for sample aliquot, sample volume, and dilutions for the analysis and meet the HRS definition of SQL (Ref. 1, Section 1.1, Table 2-3; Ref. 24, p. 4; Ref. 26, pp. 3, 311; Ref. 48, pp. 1-2).

J For semivolatile compounds, identification of analyte is acceptable; the reported value is an estimate because the samples were extracted past holding time. Concentrations should be considered minimum values (Ref. 26, p. 432). The estimated values are biased low (Ref. 26, p. 432; Ref. 50, p. 1). For all other compounds, identification of analyte is acceptable; the reported value is an estimate due to outlying quality control parameters (Ref. 26, pp. 3, 695).

Attribution

Association with Sources

Sources containing hazardous substances and releases of hazardous substances from these sources have been documented at this site, as discussed in Section 2.2 Source Characterization and Section 4.1.2.1.1 Observed Release of this HRS Documentation Record. Samples collected from overland drainage routes document hazardous substance migration from site sources to the surface water pathway (Ref. 25, pp. 16, 21, 22). The following soil/sediment samples are included to support migration of site-related contamination along the overland flow segments from the sources to the probable points of entry to the contiguous wetland and Hayes Creek.

Station Location (CLP Sample No.)	Sampling Location	Sample Date (Military Time)	Reference
EPA SR Sampling Event – August 2012			
RD-02 (RD-02-03-51) Field Duplicate (RD-02-03-52)	At an active seep on the southern end of the railroad ditch located on east side of the rail spurs and west of the railroad tracks.	08/15/2012 (0905)	Ref. 25, p. 21; Ref. 30, p. 9; Attachment A, Figure A-5
OP-01 (OP-01-03-51)	Outfall pipe located on east side of RD-01 and the rail spurs.	08/15/2012 (0855)	Ref. 25, p. 22; Ref. 30, p. 8; Attachment A, Figure A-5
OP-02 (OP-02-03-51)	Outfall pipe located on west side of Ponds 710-712 and wetland area.	08/15/2012 (1230)	Ref. 25, p. 22; Ref. 30, p. 10; Attachment A, Figure A-5
DD-05 (DD-05-03-51) Field Duplicate (DD-05-03-52)	Located where pipe from weir system enters the drainage ditch at southern end of Pond 712.	08/16/2012 (0920)	Ref. 25, p. 12; Ref. 30, p. 12; Attachment A, Figure A-5

Analytical results from soil/sediment samples collected from overland flow pathways are included to support migration of site-related contamination along the overland flow segment from site sources to the PPEs only. The analytical results from these samples were not used to score the site, but to support attribution.

Station Location (CLP Sample No.)	Hazardous Substance	Concentration[2] mg/kg	RL[1] mg/kg	Reference
EPA SR Sampling Event – August 2012				
RD-02 (RD-02-03-51)	Arsenic	1.5	0.5	Ref. 5, p.23; Ref. 26, pp. 1-3, 101
	Chromium	3.8	1.0	Ref. 5, p.23; Ref. 26, pp. 1-3, 101
	Manganese	23.6	0.5	Ref. 5, p.23; Ref. 26, pp. 1-3, 101
	Mercury	0.186	0.054	Ref. 5, p. 23; Ref. 26, pp. 1-3, 102
	2-Methylnaphthalene	0.0949 J	0.0516	Ref. 5, p. 23; Ref. 26, pp. 431-433, 522
	Benzo(a)anthracene	0.383 J	0.0516	Ref. 5, p. 23; Ref. 26, pp. 431-433, 522
	Benzo(a)pyrene	0.201 J	0.0516	Ref. 5, p. 23; Ref. 26, pp. 431-433, 522
	Benzo(g,h,i)perylene	0.123 J	0.0516	Ref. 5, p. 24; Ref. 26, pp. 431-433, 522
	Fluoranthene	0.0754 J	0.0516	Ref. 5, p. 24; Ref. 26, pp. 431-433, 522
	Indeno(1,2,3-cd)pyrene	0.0646 J	0.0516	Ref. 5, p. 24; Ref. 26, pp. 431-433, 522

Station Location (CLP Sample No.)	Hazardous Substance	Concentration[2] mg/kg	RL[1] mg/kg	Reference
RD-02 (RD-02-03-52)	Arsenic	1.4	0.5	Ref. 5, p.23; Ref. 26, pp. 1-3, 105
	Chromium	2.9	1.0	Ref. 5, p.23; Ref. 26, pp. 1-3, 105
	Manganese	28.3	0.5	Ref. 5, p.23; Ref. 26, pp. 1-3, 105
	Mercury	0.143	0.067	Ref. 5, p.23; Ref. 26, pp. 1-3, 106
	2-Methylnaphthalene	0.244 J	0.0502	Ref. 5, p. 23; Ref. 26, pp. 431-433, 526
	Benzo(a)anthracene	0.276 J	0.0502	Ref. 5, p. 23; Ref. 26, pp. 431-433, 526
	Benzo(a)pyrene	0.117 J	0.0502	Ref. 5, p. 24; Ref. 26, pp. 431-433, 526
	Benzo(g,h,i)perylene	0.102 J	0.0502	Ref. 5, p. 24; Ref. 26, pp. 431-433, 526
	Indeno(1,2,3-cd)pyrene	0.0518 J	0.0502	Ref. 5, p. 24; Ref. 26, pp. 431-433, 526
OP-01 (OP-01-03-51)	Arsenic	1.9	0.6	Ref. 5, p. 21; Ref. 26, pp. 1-3, 93
	Chromium	3.9	1.1	Ref. 5, p. 21; Ref. 26, pp. 1-3, 93
	Manganese	34.4	0.6	Ref. 5, p. 21; Ref. 26, pp. 1-3, 93
	Mercury	0.089	0.056	Ref. 5, p. 21; Ref. 26, pp. 1-3, 94
	Benzo(a)anthracene	0.0194 J	0.0122	Ref. 5, p. 21; Ref. 26, pp. 431-433, 514
	Benzo(a)pyrene	0.0261 J	0.0122	Ref. 5, p. 21; Ref. 26, pp. 431-433, 514
	Benzo(g,h,i)perylene	0.0253 J	0.0122	Ref. 5, p. 22; Ref. 26, pp. 431-433, 514
	Fluoranthene	0.0151 J	0.0122	Ref. 5, p. 22; Ref. 26, pp. 431-433, 514
	Indeno(1,2,3-cd)pyrene	0.0148 J	0.0122	Ref. 5, p. 22; Ref. 26, pp. 431-433, 514
	Phenanthrene	0.0242 J	0.0122	Ref. 5, p. 22; Ref. 26, pp. 431-433, 514
OP-02 (OP-02-03-51)	Arsenic	1.3	0.6	Ref. 5, p. 21; Ref. 26, pp. 1-3, 117
	Chromium	3.0	1.2	Ref. 5, p. 21; Ref. 26, pp. 1-3, 117
	Manganese	24.1	0.6	Ref. 5, p. 21; Ref. 26, pp. 1-3, 117
	Mercury	0.078	0.065	Ref. 5, p. 21; Ref. 26, pp. 1-3, 118
	Benzo(a)anthracene	0.412 J	0.027	Ref. 5, p. 21; Ref. 26, pp. 431-433, 538
	Benzo(a)pyrene	0.135 J	0.027	Ref. 5, p. 21; Ref. 26, pp. 431-433, 538
	Benzo(g,h,i)perylene	0.0751 J	0.027	Ref. 5, p. 22; Ref. 26, pp. 431-433, 538
	Fluoranthene	0.289 J	0.027	Ref. 5, p. 22; Ref. 26, pp. 431-433, 538
	Indeno(1,2,3-cd)pyrene	0.0315 J	0.027	Ref. 5, p. 22; Ref. 26, pp. 431-433, 538
	Phenanthrene	0.0376 J	0.027	Ref. 5, p. 22; Ref. 26, pp. 431-433, 538
DD-05 (DD-05-03-51)	Arsenic	2.1	0.8	Ref. 5, p. 21; Ref. 26, pp. 1-3, 173
	Chromium	7.2	1.6	Ref. 5, p. 21; Ref. 26, pp. 1-3, 173
	Manganese	83.8	0.8	Ref. 5, p. 21; Ref. 26, pp. 1-3, 173
	Mercury	0.170	0.094	Ref. 5, p. 21; Ref. 26, pp. 1-3, 174
	Zinc	201	3.2	Ref. 5, p. 21; Ref. 26, pp. 1-3, 173
DD-05 (DD-05-03-52)	Arsenic	1.5	0.6	Ref. 5, p. 21; Ref. 26, pp. 1-3, 181
	Chromium	5.6	1.2	Ref. 5, p. 21; Ref. 26, pp. 1-3, 181
	Manganese	61.9	0.6	Ref. 5, p. 21; Ref. 26, pp. 1-3, 181
	Mercury	0.078	0.071	Ref. 5, p. 21; Ref. 26, pp. 1-3, 182
	Zinc	84.2	2.5	Ref. 5, p. 21; Ref. 26, pp. 1-3, 181
	Benzo(a)pyrene	0.0184 J	0.0089	Ref. 5, p. 22; Ref. 26, pp. 431-433, 594
	Benzo(g,h,i)perylene	0.0158 J	0.0089	Ref. 5, p. 22; Ref. 26, pp. 431-433, 594
	2-Methylnaphthalene	0.0327 J	0.0089	Ref. 5, p. 22; Ref. 26, pp. 431-433, 594
	Phenanthrene	0.0336 J	0.0089	Ref. 5, p. 22; Ref. 26, pp. 431-433, 594

Notes:

mg/kg = milligrams per kilogram = 1,000 micrograms per kilogram (µg/kg)

[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory are detection limits which have been adjusted for sample aliquot, sample volume, and dilutions for the analysis and meet the HRS definition of SQL (Ref. 1, Section 1.1, Table 2-3; Ref. 24, p. 4; Ref. 26, pp. 3, 311; Ref. 48, pp. 1-2).

J Identification of analyte is acceptable; the reported value is an estimate because the samples were extracted past holding time. Concentrations should be considered minimum values (Ref. 26, p. 432). The estimated values are biased low (Ref. 26, p. 432; Ref. 50, p. 1).

The ground water plume under the property also shows migration of contamination from the property During sampling conducted in 2011 by ADEQ contractors, concentrations of benzene and naphthalene were detected (Ref. 6, pp. 97, 98). Ground water at the property is shallow at approximately 8 ft. bgs (Ref. 6, p. 84). With the property at 50 feet above Hayes Creek, the ground water at the property is at a higher elevation than the adjacent surface water at Hayes Creek (Ref. 40, p. 1).

Active seeps, which contain waste, are visible throughout the property. The waste follows the ground water gradient to the north-northeast toward Hayes Creek, south-southeast toward Massey Creek and south towards the convergence of the two creeks and emerges through the seeps, several of which are located adjacent to the railroad tracks. One such seep, RD-02, was sampled during the 2012 EPA SR. RD-02 contained arsenic, chromium, manganese, mercury, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene (Ref. 5, pp. 23, 24; Ref. 26, pp. 105, 106, 526). The waste in the seeps is then carried through overland flow, discharging through piping located on the east side of the property. These pipes actively discharge waste into the wetland area (Ref. 6, pp. 12, 13, 43, 90, 123, 134, 140; Ref. 15, pp. 14, 15, 17- 22, 25,-31, 33-41; Ref. 22, pp. 9, 12). Sample OP-02 was collected at an outfall pipe location just west of the wetland during the 2012 EPA SR and contained arsenic, chromium, manganese, mercury, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, fluoranthene, indeno(1,2,3-cd)pyrene, and phenanthrene (Ref. 5, pp. 13, 21, 22; Ref. 22, p. 12; Ref. 26, p. 117, 118, 538; Ref. 30, pp. 3, 10; Ref. 39, pp. 1-2).

During the 2012 SR, two ground water samples were collected. One sample was designated as background and collected upgradient of the property, while the other (NCI-3) was collected on the east side of the property along the railroad spurs (Ref. 5, p. 4; Ref. 30, pp.24, 25). The following ground water sample is included to support migration of site-related contamination from the sources.

Station Location (CLP Sample No.)	Hazardous Substance	Concentration mg/L	RL[1] mg/L	Reference
EPA SR Sampling Event – August 2012				
NCI-3 (NCI-3-120815-21)	Zinc	2.05	0.02	Ref. 5, p.38; Ref. 26, pp. 1-3, 193
	2-Methylnaphthalene	8.6	1.9	Ref. 5, p.83; Ref. 26, pp. 431-433, 603
	Naphthalene	19.6	1.9	Ref. 5, p.38; Ref. 26, pp. 431-433, 603

Notes:
mg/L = milligram per liter for aqueous liquid = 1,000 microgram per liter (ug/L).
[1] The Reporting Limit (RL) terminology used by the EPA Region 6 Laboratory are detection limits which have been adjusted for sample aliquot, sample volume, and dilutions for the analysis and meet the HRS definition of SQL (Ref. 1, Section 1.1, Table 2-3; Ref. 24, p. 4; Ref. 26, pp. 3, 311; Ref. 48, pp. 1-2).

Results of attribution soil/sediment and ground water samples revealed detects of several metals and PAHs as shown above. Of the metals and PAHs detected above in attribution soil/sediment samples, arsenic, chromium, manganese, vanadium, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene were also detected within Hayes Creek at concentrations meeting observed release criteria (Ref. 1, Table 2-3). Although low levels of PAHs are consistent with oil waste, these contaminants are also present within the CERCLA eligible wastes. In addition, elements such as chromium, hexavalent chromium, mercury, and zinc are present within the sources and these contaminants are not associated with OPA wastes, but with the RCRA hazardous K048 through K052 wastes (Ref. 31, pp. 12-16, 18-23, 25).

The facility historically has had a mix of OPA and CERCLA-eligible wastes. It was discovered near the end of the OPA response, from state records and conversations with a former employee, that the impoundments (ponds) had been contaminated with the following listed RCRA hazardous wastes generated by petroleum refining operations: K048- DAF, K049 – slop oil emulsion solids, K050 – heat exchanger bundle cleaning sludge, K051- API separator sludge, and K052 – tank bottoms. These RCRA hazardous wastes also constitute CERCLA eligible wastes and have commingled with the contents of OPA regulated wastes (Ref. 43, p. 3).

Historical operations at the facility have been demonstrated to cause, among others, arsenic, chromium, manganese, vanadium, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, and Indeno(1,2,3-cd)pyrene contamination based on sampling results of sources. The presence of these substances in sources at the site, combined with the overall lack of containment of the sources, and the fact that contaminated soil/sediment samples of overland flow pathways and ground water samples are present, support contamination migration of these same compounds from sources at the site into the surface water pathway. The contamination of, among others, arsenic, chromium, manganese, vanadium, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene in sediments can be attributed (wholly or, at least, in part) to the MacMillan operations.

Consideration of Other Possible Off-Site Sources

Searches of the Toxic Release Inventory (TRI) and EPA EnviroMapper for Envirofacts databases were performed within the zip code of the site location. Three facilities were identified upgradient along Hayes Creek (Ref. 33, pp. 1 -2). Rolling Frito Lay Sales, Welsco Inc., and Cross Oil Refining and Marketing, Inc. Rolling Frito Lay is a local trucking facility; Welsco is an industrial gas facility; and

Cross Oil Refining and Marketing, Inc. is a petroleum refining facility (Ref. 33, pp. 3-20). No nearby facilities along the surface water pathway are reported to have had a release of arsenic, chromium, manganese, vanadium, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene according to the TRI database (Ref. 32, pp. 1-2).

Although MacMillan is located in an area with other petroleum and oil industries, the closest such, facility is Cross Oil Refining, located approximately 5-miles upstream along Hayes Creek (Ref. 33, p. 1). The background sample collected for the site is deemed an appropriate background sample for the purposes of evaluating the site under the EPA's HRS as the analytical results from the background sample is indicative of the highly petroleum industrialized area. Samples meeting observed release criteria, or displaying concentrations that are three times greater than the highest background concentration of a particular analyte were collected at the site and from within the surface water pathway. Further, analytical results from samples collected from the sources at the site displayed the presence of the same contaminants as the samples collected from the surface water pathway meeting observed release criteria.

Observed Release Factor

Based on the analytical data and attribution components listed above, arsenic, chromium, chromium (VI), lead, manganese, mercury, vanadium, zinc, anthracene, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene have been documented as the hazardous substances in the observed release to the wetland contiguous to Hayes Creek and Hayes Creek. Therefore, the observed release factor value of 550 was assigned (Ref. 1, Section 4.1.2.1.1).

Observed Release Factor Value: 550

4.1.2.1.2 POTENTIAL TO RELEASE

4.1.2.1.2.1 Potential to Release by Overland Flow

Potential to release was not evaluated because an observed release to the surface water pathway was established by direct observation and chemical analysis (see Section 4.1.2.1.1 of this HRS Documentation Record).

4.1.3 HUMAN FOOD CHAIN THREAT

4.1.3.2 WASTE CHARACTERISTICS

Evidence of contamination associated with Source 1 and Source 2 have been established based on chemical analyses of samples collected from the sources (refer to the Attribution section and Section 2.2). Arsenic, chromium, lead, manganese, mercury, vanadium, zinc, anthracene, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene were detected in sediment samples collected in the surface water pathway, thus establishing an observed release (see Section 4.1.2.1.1 of this HRS Documentation Record).

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source Number	Toxicity Factor Value	Persistence Factor Value[1]	Food Chain Bioaccumulation Value Fresh Water[2]	Toxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Arsenic	1,OR	10,000	1	5	5×10^4	Ref. 2, p. 6
Acenaphthylene	1,2	0	0.4	500	0	Ref. 2, p. 6
Anthracene	1,2,OR	10	0.4	50,000	2×10^5	Ref. 2, p. 6
Benzo(a)anthracene	1,2,OR	1,000	1	50,000	5×10^7	Ref. 2, p. 7
Benzo(a)pyrene	1,2,OR	10,000	1	50,000	5×10^8	Ref. 2, p. 7
Benzo(k)fluoranthene	1,OR	100	1	50,000	5×10^6	Ref. 2, p. 7
Benzo(g,h,i)perylene	1,OR	0	1	50,000	0	Ref. 2, p. 7
Chromium	1,2,OR	10,000	1	500	5×10^6	Ref. 2, p. 8
Chromium(IV)	1,OR	10,000	1	5	5×10^4	Ref. 2, p. 8
Chrysene	1,2,OR	10	1	5	5×10^1	Ref. 2, p. 8
Dibenz(a,h)anthracene	1	10,000	1	50,000	5×10^8	Ref. 2, p. 9
Indeno(1,2,3-cd)pyrene	1,OR	1,000	1	50,000	5×10^7	Ref. 2, p. 13
Lead	1,2,OR	10,000	1	5	5×10^4	Ref. 2, p. 13
Manganese	1,OR	10,000	1	50,000	5×10^8	Ref. 2, p. 13
Mercury	1, OR	10,000	0.4	50,000	2×10^8	Ref. 2, p. 13
2-Methylnaphthalene	1,2,OR	1,000	0.4	50,000	2×10^7	Ref. 2, p. 14
Naphthalene	1,2, OR	1,000	0.4	50,000	2×10^7	Ref. 2, p. 14
Phenanthrene	1,2,OR	0	0.4	5,000	0	Ref. 2, p. 14
Pyrene	1,2, OR	100	1	50,000	5×10^6	Ref. 2, p. 15
Vanadium	1,2, OR	100	1	500	5×10^4	Ref. 2, p. 16
Zinc	1, OR	10	1	5	5×10^1	Ref. 2, p. 17

Notes:
OR – Observed Release

[1] The surface water category that includes rivers, oceans, coastal tidal waters, and great lakes was utilized to assign the hazardous substances persistence factor value (Ref. 1, Sec. 4.1.2.2.1.2). The persistence values for rivers were assigned according to the Superfund Chemical Data Matrix (SCDM) Table (Ref. 2).

[2] Bioaccumulation factor values are assigned from the SCDM (Ref. 2), for "Fresh Water" in which the fishery is located (Ref. 1, Sect. 4.1.3.2.1.3).

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.3.2.2 Hazardous Waste Quantity

Source No.	Source Hazardous Waste Quantity Value	Containment Factor Value			
		Ground Water	Surface Water	Gas	Air Particulate
1	6,253.846	NE	10	NE	NE
2	14,896.923	NE	10	NE	NE
TOTAL	21,150.769				

NE = Not Evaluated

A hazardous waste quantity of 21,150.769 is estimated for sources at the MacMillan site, which when applied in HRS Table 2-6, yields a pathway hazardous waste quantity of 10,000.

Hazardous Waste Quantity Factor Value = 10,000

4.1.4.2.3 Waste Characteristics Factor Category Value

Toxicity/Persistence Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 10,000
Bioaccumulation Potential Factor Value: 50,000

(Toxicity/Persistence Factor Value) x (Hazardous Waste Quantity Factor Value) = 1×10^8
(Toxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value) x (Bioaccumulation Potential Factor Value) = 5×10^{12}
(Ref. 1, Section 4.1.3.2.3).

A hazardous waste quantity factor of 10,000 is assigned according to HRS Section 2.4.2.2. From Reference 2 and Table 4-12 of the HRS, benzo(a)pyrene and manganese have a toxicity/persistence value of 10,000 and a bioaccumulation potential factor of 50,000. The waste characteristics factor category value from Reference 1, Table 2-7 for a waste characteristics product of 5×10^{12} is 1,000.

Hazardous Waste Quantity Assigned Value: 10,000

Waste Characteristics Factor Category Value: 1,000

4.1.3.3 TARGETS

4.1.3.3.1 Food Chain Individual

Fishing is documented within the TDL and occurs within Smackover Creek and the Ouachita River (Ref. 36, p. 1). Fishermen along Smackover Creek and the Ouachita River catch bass, bream (sunfish), crappie, and catfish. These fish are used for personal consumption (Ref. 36, p. 1).

Fishery	Type of Surface Water Body	Reference(s)
Smackover Creek	Large River	Ref. 37
Ouachita River	Large River	Ref. 38

An observed release by chemical analysis and an observed release by direct observation are established to the surface water migration pathway (See Section 4.1.2.1.1 of this HRS Documentation Record). Since this information documents an observed release of a hazardous substance having a bioaccumulation factor of 500 or greater to surface water (Hayes Creek) in the watershed and there is a fishery present within the TDL, a food chain individual value of 20 was assigned (Ref. 1, Section 4.1.3.3.1; Ref. 36, p. 1).

Food Chain Individual Factor Value: 20

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

Level I concentrations have not been established as fish tissue samples have not been collected; therefore, the Level I concentrations factor value receives an assigned value of 0.

Level I Concentration Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

Level II concentrations have not been established within the fishery; therefore, the Level II concentrations factor value receives an assigned value of 0.

Level II Concentration Factor Value: 0

4.1.3.3.2.3 Potential Human Food Chain Contamination

Identity of Fishery	Annual Production (pounds)	Type of Surface Water Body	Average Annual Flow	Reference	Population Value (P_i)	Dilution Weight (D_i)	$P_i \times D_i$
Smackover Creek	>0, but unknown	Large River	18,770 cfs	Ref. 1, Tables 4-13, 4-18; Ref. 37, p. 1	0.03	0.0001	0.000003
Ouachita River	>0, but unknown	Large River	30,350 cfs	Ref. 1, Tables 4-13, 4-18; Ref. 38, p. 1	0.03	0.0001	0.000003

Notes:
cfs = cubic feet per second.

Smackover Creek and Ouachita River are fished for bass, bream (sunfish), crappie, and catfish according to the Arkansas Game and Fish Commission; these fish are caught for human consumption (Ref. 36). Data to estimate pounds of fish caught annually for Smackover Creek and Ouachita River are not available; however, because these water bodies are fished, the annual production is known to be greater than zero. As such, a human food chain population value of 0.03 is assigned from Table 4-18 of the HRS Rule (Ref. 1, Table 4-18). For Smackover Creek and Ouachita River, the dilution weight was based on the average annual flow data collected by the United States Geological Survey (USGS) at a gauging stations located upstream of the TDL (Ref. 37; Ref. 38). Based on the stream flow, Smackover Creek and Ouachita River, according to Table 4-13 of the HRS Rule, are classified as large rivers and receive an assigned dilution weight of 0.0001 (Ref. 1, Table 4-13).

Smackover Creek and Ouachita River - Product of $P_i \times D_i = 0.06 \times 0.0001$

Product of $P_i \times D_i$: 0.000006

(Sum of Products of $P_i \times D_i$)/10: 0.0000006

4.1.4 ENVIRONMENTAL THREAT

4.1.4.2 WASTE CHARACTERISTICS

Evidence of contamination associated with Sources 1 and 2 have been established based on chemical analyses of samples collected from these sources (refer to the Attribution Section and Section 2.2 of this HRS Documentation Record). Arsenic, chromium, chromium (VI) lead, manganese, mercury, vanadium, zinc, anthracene, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene were detected in sediment samples collected within the contiguous wetland and Hayes Creek, establishing an observed release (see Section 4.1.2.1.1).

4.1.4.2.1 Ecotoxicity/Persistence/Bioaccumulation

Hazardous Substance	Source Number	Ecotoxicity Factor Value Fresh[2]	Persistence[1] Factor Value	Ecosystem Bioaccumulation Potential Factor Value Fresh Water[2]	Ecotoxicity/ Persistence/ Bioaccumulation Factor Value	Reference
Arsenic	1,OR	10	1	5,000	5×10^4	Ref. 2, p. 6
Anthracene	1,2,OR	10,000	0.4	50,000	2×10^8	Ref. 2, p. 6
Benzo(a)anthracene	1,2,OR	10,000	1	50,000	5×10^8	Ref. 2, p. 7
Benzo(a)pyrene	1,OR	10,000	1	50,000	5×10^8	Ref. 2, p. 7
Benzo(k)fluoranthene	1, R	0	1	50,000	0	Ref. 2, p. 7
Benzo(g,h,i)perylene	1,OR	0	1	50,000	0	Ref. 2, p. 7
Chromium	1,2,OR	10,000	1	500	5×10^6	Ref. 2, p. 8
Chromium(IV)	1,OR	100	1	5	5×10^2	Ref. 2, p. 8
Chrysene	1,2,OR	1,000	1	5,000	5×10^6	Ref. 2, p. 8
Dibenz(a,h)anthracene	1	0	1	50,000	0	Ref. 2, p. 9
Indeno(1,2,3-cd)pyrene	1,OR	0	1	50,000	0	Ref. 2, p. 13
Lead	1,2,OR	1,000	1	50,000	5×10^7	Ref. 2, p. 13
Manganese	1,OR	0	1	50,000	0	Ref. 2, p. 13
Mercury	1,OR	10,000	0.4	50,000	2×10^8	Ref. 2, p. 13
2-Methylnaphthalene	1,2,OR	100	0.4	50,000	2×10^6	Ref. 2, p. 14
Naphthalene	1,2,OR	1,000	0.4	50,000	2×10^7	Ref. 2, p. 14
Phenanthrene	1,2,OR	10,000	0.4	50,000	2×10^8	Ref. 2, p. 14
Pyrene	1,2,OR	10,000	1	50,000	5×10^8	Ref. 2, p. 15
Vanadium	1,2,OR	0	1	500	0	Ref. 2, p. 16
Zinc	1,OR	10	1	50,000	5×10^5	Ref. 2, p. 17

Notes:
OR – Observed Release
[1] The surface water category that includes rivers, oceans, coastal tidal waters, and great lakes was utilized to assign the hazardous substances persistence factor value (Ref. 1, Sec. 4.1.2.2.1.2). The persistence values for all the compounds listed were for rivers

[2] which includes the contiguous wetland and Hayes Creek according to the Superfund Chemical Data Matrix (SCDM) table (Ref. 2). Bioaccumulation factor values are assigned from the SCDM (Ref. 2), for "Fresh Water" in which the wetland contiguous to Hayes Creek and sensitive environment are located (Ref. 1, Sect. 4.1.3.2.1.3).

Ecotoxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.4.2.2 Hazardous Waste Quantity

Source No.	Source Hazardous Waste Quantity Value	Containment Factor Value			
		Ground Water	Surface Water	Gas	Air Particulate
1	6,253.846	NE	10	NE	NE
2	14,896.923	NE	10	NE	NE
TOTAL	21,150.769				

NE = Not Evaluated

A hazardous waste quantity of 21,150.769 is estimated for sources at the MacMillan site, which when applied in HRS Table 2-6, yields a pathway hazardous waste quantity of 10,000. Also, as documented in Sections 4.1.2.1.1 and 4.1.4.3.1.2 of this HRS Documentation Record, a wetland is subject to Level II concentrations; therefore, a minimum value of 100 can be assigned for the hazardous waste quantity factor value (Ref. 1, Section 2.4.2.2).

Hazardous Waste Quantity Factor Value = 10,000

4.1.4.2.3 Waste Characteristics Factor Category Value

Ecotoxicity/Persistence Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 10,000
Bioaccumulation Potential Factor Value: 50,000

(Ecotoxicity/Persistence Factor Value) x (Hazardous Waste Quantity Factor Value) = 1×10^8
(Ecotoxicity/Persistence Factor Value x Hazardous Waste Quantity Factor Value) x (Bioaccumulation Potential Factor Value) = 5×10^{12}
(Ref. 1, Section 4.1.3.2.3).

A hazardous waste quantity factor of 10,000 is assigned according to HRS Section 2.4.2.2. From Reference 2 and Table 4-12 of the HRS, benzo(a)anthracene and benzo(a)pyrene have an ecotoxicity/persistence value of 10,000 and a bioaccumulation potential factor of 50,000. The waste characteristics factor category value from Reference 1, Table 2-7 for a waste characteristics product of 5×10^{12} is 1,000.

Hazardous Waste Quantity Assigned Value: 10,000

Waste Characteristics Factor Category Value: 1,000

4.1.4.3.1 SENSITIVE ENVIRONMENTS

4.1.4.3.1.1 Level I Concentrations

No Level I concentrations have been documented; therefore, Level I concentrations were not evaluated. Level I concentrations factor value receives an assigned value of 0.

Level I Concentration Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

Wetlands

The area of Level II contamination includes the perimeter of the wetlands where observed release concentrations of contaminants were detected (Ref. 1, Section 4.1.2.1.1). The perimeter of the wetland contiguous to Hayes Creek determined to be affected by Level II concentrations was approximately 980 linear feet (Ref. 16, pp. 1-13; Ref. 34, pp. 1-2). The total length of the wetland contiguous to Hayes Creek was determined in accordance with Sections 4.1.4.3.1.1 and 4.1.4.3.1.2 of the HRS (Ref. 1) and was calculated by measuring the perimeter of the wetland contiguous to Hayes Creek subject to Level II concentrations as the length **(**Ref. 1, Sections 4.1.4.3.1.1 and 4.1.4.3.1.2; Ref. 24, pp. 1-2).

According to a wetlands evaluation conducted by an environmental scientist trained in wetland delineation, the area, which used to be a man-made stormwater retention pond, east of the facility, meets the 40 CFR 230.3 definition of a wetland. Although the wetland evaluation was conducted under drought conditions, historically, this area has been inundated with water as observed during previous site visits and by historical aerial photographs, and indicators of wetland hydrology, soils and vegetation were noted in the evaluation (Ref. 15, pp. 38, 41; Ref. 16, pp. 1-13; Ref. 18, pp. 1).

Total Level II Wetland Perimeter = 980 feet (0.186 miles)

Wetland Value (Ref. 1, Table 4-24): 25

Level II Concentrations Factor Value: 25

4.1.4.3.1.3 Potential Contamination

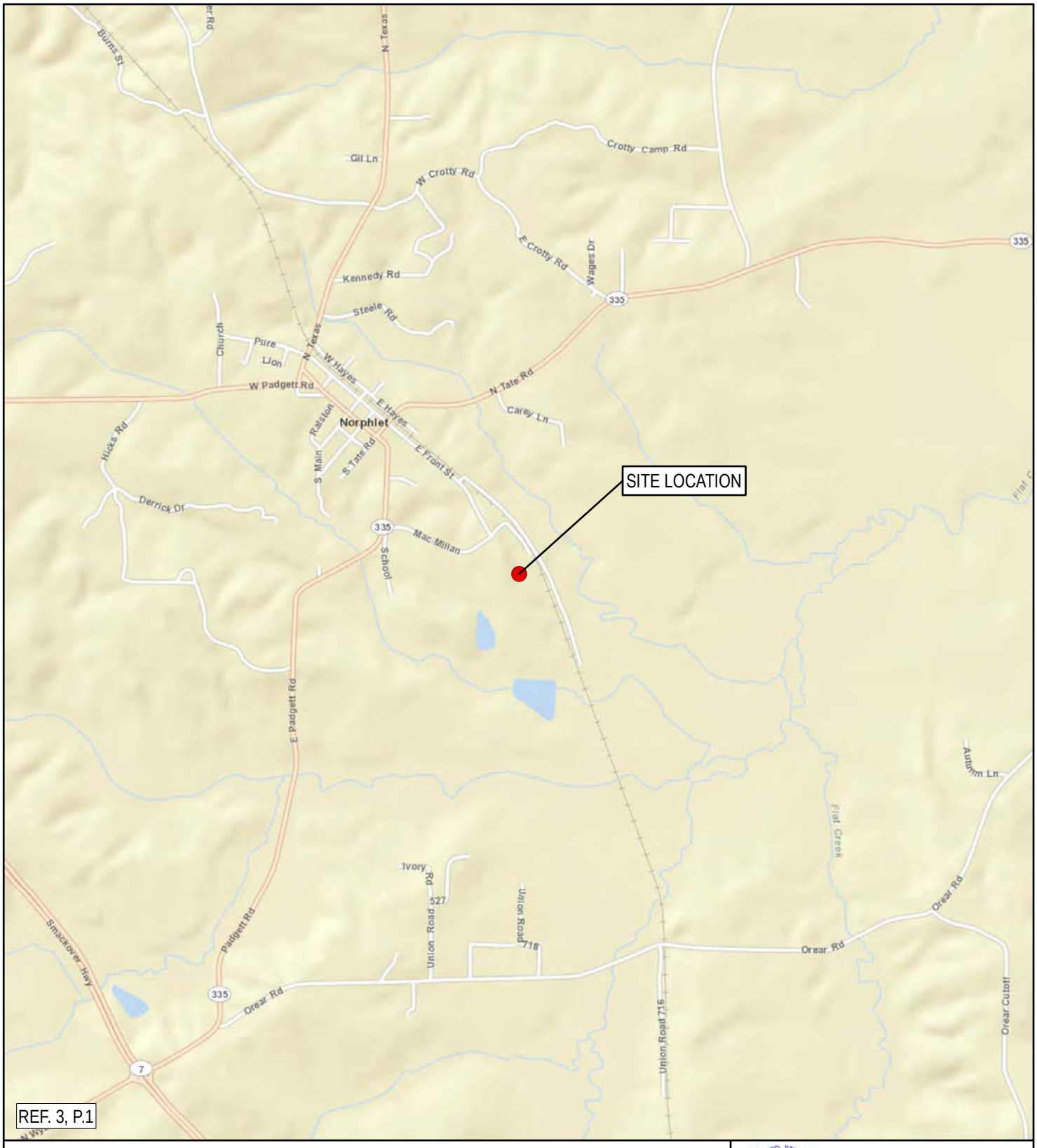
Sensitive Environments

Although wetland characteristics were not present between the farthest upstream PPE (DD-01) and farthest downstream sample (SW-05), this area is representative of a riparian habitat (Ref. 16, pp. 1-4). Riparian habitat and its diverse species represent an important component within ecosystem management. The majority of North American herpetofauna (reptiles and amphibians) inhabit wetland

habitats, including riparian areas. Reptiles and amphibians are functionally tied to riparian habitats as they provide the essential habitat for their reproductive patterns (Ref. 35, pp. 1, 11). These particular areas, relatively small in size, are important to the maintenance of unique biotic communities. This area of potential contamination within the TDL is considered a poor quality habitat due to industrial operations in the area. Therefore, this area is not included in the scoring of the site, but is presented here to illustrate a potentially affected sensitive environment.

4.2 GROUND WATER TO SURFACE WATER MIGRATION COMPONENT- NOT SCORED

Section 4.2 of the HRS states that the ground water to surface water component can be used to evaluate surface water threats that result from migration of hazardous substances from a source at the facility to surface water (Ref. 1). Although the ground water to surface water component is possible as is evidence by the active seeps on the property, the surface water likelihood of release is scored based on the overland/flood migration component as shown in Section 4.1 of this report. Since the threat of release by overland flow or flood is more than minimal for this facility and the component score sufficient to score the overall site, the ground water to surface water migration component has not been scored.


SITE LOCATION
Norphlet
Burns St
N Texas
Gil Ln
W Crotty Rd
Crotty Camp Rd
E Crotty Rd
Wages Dr
335
Kennedy Rd
Steele Rd
Church
Pure
Lion
W Padgett Rd
W Hayes
E Hayes
N Tate Rd
Carey Ln
Ralston
S Main
S Tate Rd
E Front St
Hicks Rd
Derrick Dr
Mac Millan
School
E Padgett Rd
Ivory Rd
Union Road 527
Union Road 718
Union Road 715
Padgett Rd
Smackover Hwy
7
Orear Rd
Orear Cutoff
Autumn Ln
Flat Creek
REF. 3, P.1
0
2,000
4,000
Feet
LEGEND
SITE LOCATION
Arkansas
N
US EPA REGION 6
FIGURE A-1
FACILITY LOCATION MAP
MACMILLAN RING FREE OIL CO. INC.
600 MACMILLAN RD
NORPHLET, UNION COUNTY, ARKANSAS
DATE
SEPTEMBER, 2013
PROJECT NO
20406.012.019.0718.01
SCALE
AS SHOWN
TDD NO: TO-0019-12-03-01
CERCLIS NO: ARD008049207
SOURCE: ESRI StreetMap and Data Partners
FILE: L:\20406_START3_R6\NORPHLET_CHEMICAL\GIS\FIGURE_A-1_SITE_LOCATION_MAP-TOPO.mxd 9:59:49 AM 9/6/2013 bondp

0 550 1,100

Feet

LEGEND

FORMER PONDS

PROPERTY BOUNDARY

LEVEL II WETLAND AREA

TDD NO: TO-0019-12-03-01
CERCLIS NO: ARD008049207

SOURCE: (c) 2010 Microsoft Corporation and its data suppliers

US EPA REGION 6

FIGURE A-2
PROPERTY LAYOUT MAP
MACMILLAN RING FREE OIL CO. INC.
600 MACMILLAN RD
NORPHLET, UNION COUNTY, ARKANSAS

DATE	PROJECT NO	SCALE
SEPTEMBER, 2013	20406.012.019.0718.01	AS SHOWN

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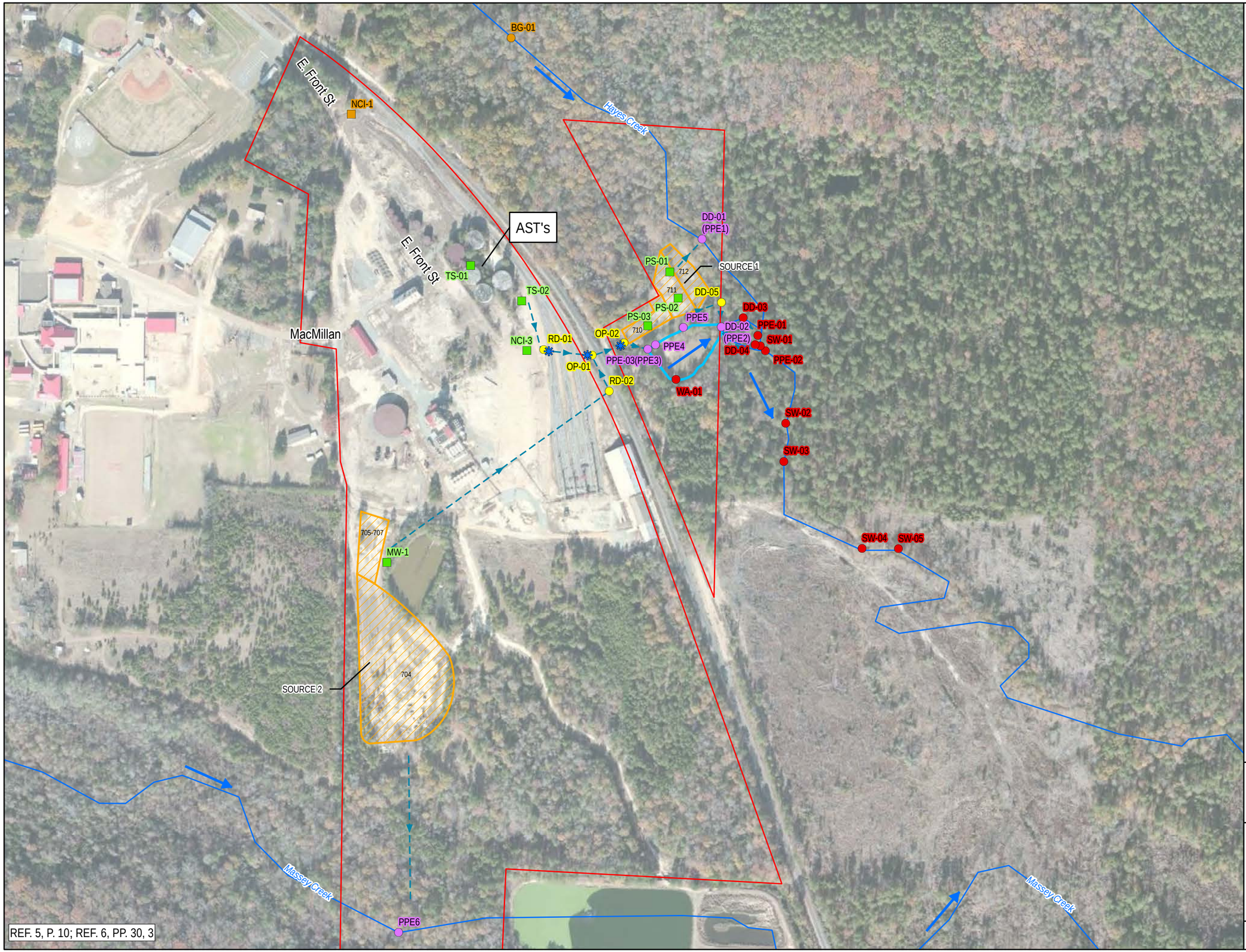


LEGEND

- SURFACE WATER FLOW DIRECTION
- OVERLAND FLOW
- OUTFALL PIPE
- BACKGROUND GROUNDWATER SAMPLE
- BACKGROUND SEDIMENT SAMPLE
- LEVEL II SEDIMENT SAMPLE
- PROBABLE POINT OF ENTRY
- SEDIMENT CHARACTERIZATION SAMPLE
- SOURCE CLASSIFICATION SAMPLE
- LEVEL II WETLAND AREA
- PROPERTY BOUNDARY
- FORMER PONDS

N

0 320 640

Feet

TDD NO: TO-0019-12-03-01
CERCLIS NO: ARD008049207

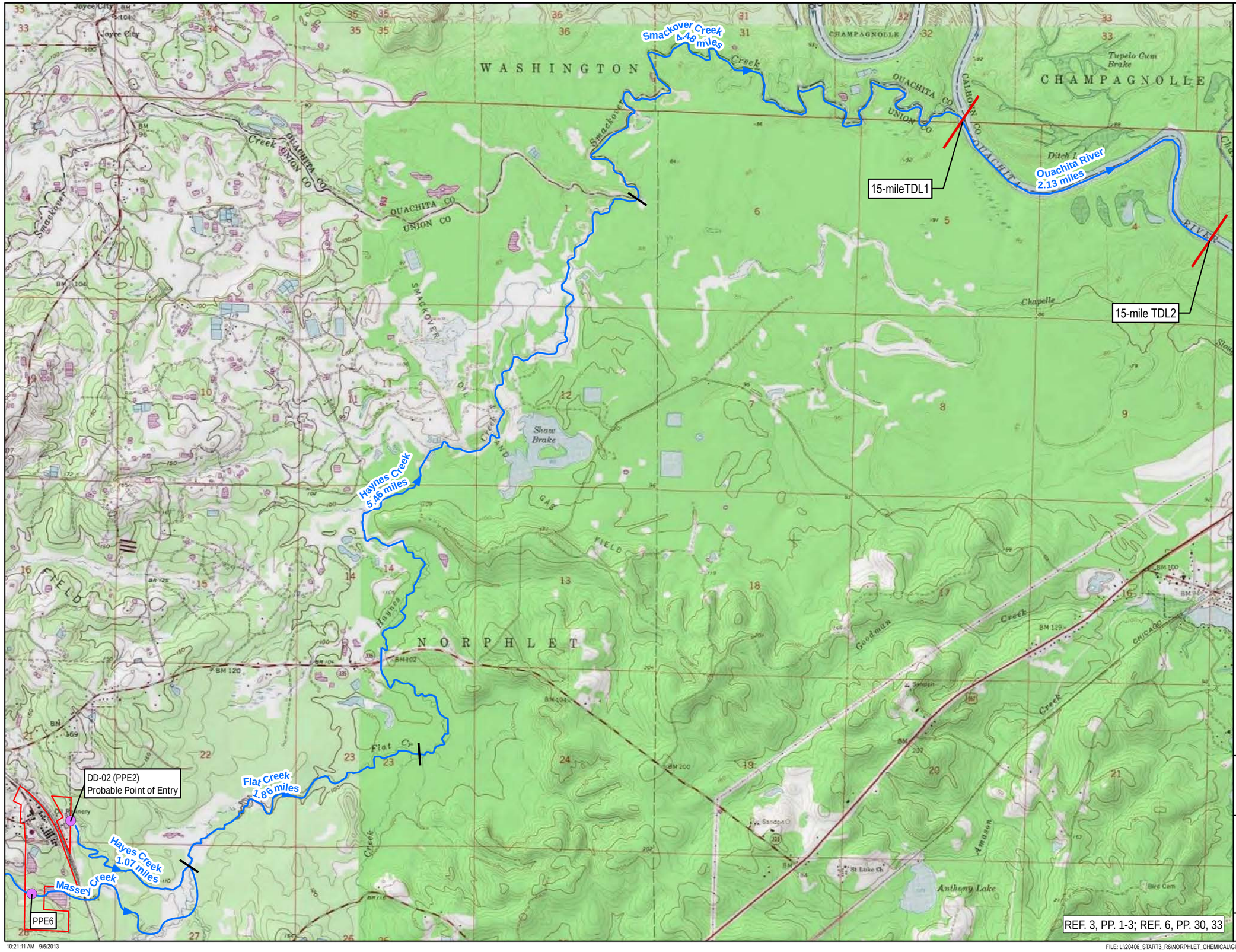
US EPA REGION 6

FIGURE A-3
SURFACE WATER PATHWAY MAP
MACMILLAN RING FREE OIL CO. INC.
600 MACMILLAN RD
NORPHLET, UNION COUNTY, ARKANSAS

DATE	PROJECT NO	SCALE
SEPTEMBER, 2013	20406.012.019.0718.01	AS SHOWN

1:19:42 PM 9/6/2013

FILE: L:\20406_START3_R6\NORPHLET_CHEMICAL\GIS\FIGURE_A-3_SURFACE WATER PATHWAY MAP.mxd 1:19:42 PM 9/6/2013 bondp



LEGEND

- 15-MILE TARGET DISTANCE LIMIT
- UPSTREAM PROBABLE POINT OF ENTRY
- PROPERTY BOUNDARY

N

0 0.5 1

Miles

TDD NO: TO-0019-12-03-01
CERCLIS NO: ARD008049207

SOURCE: © 2011 National Geographic Society, i-cubed

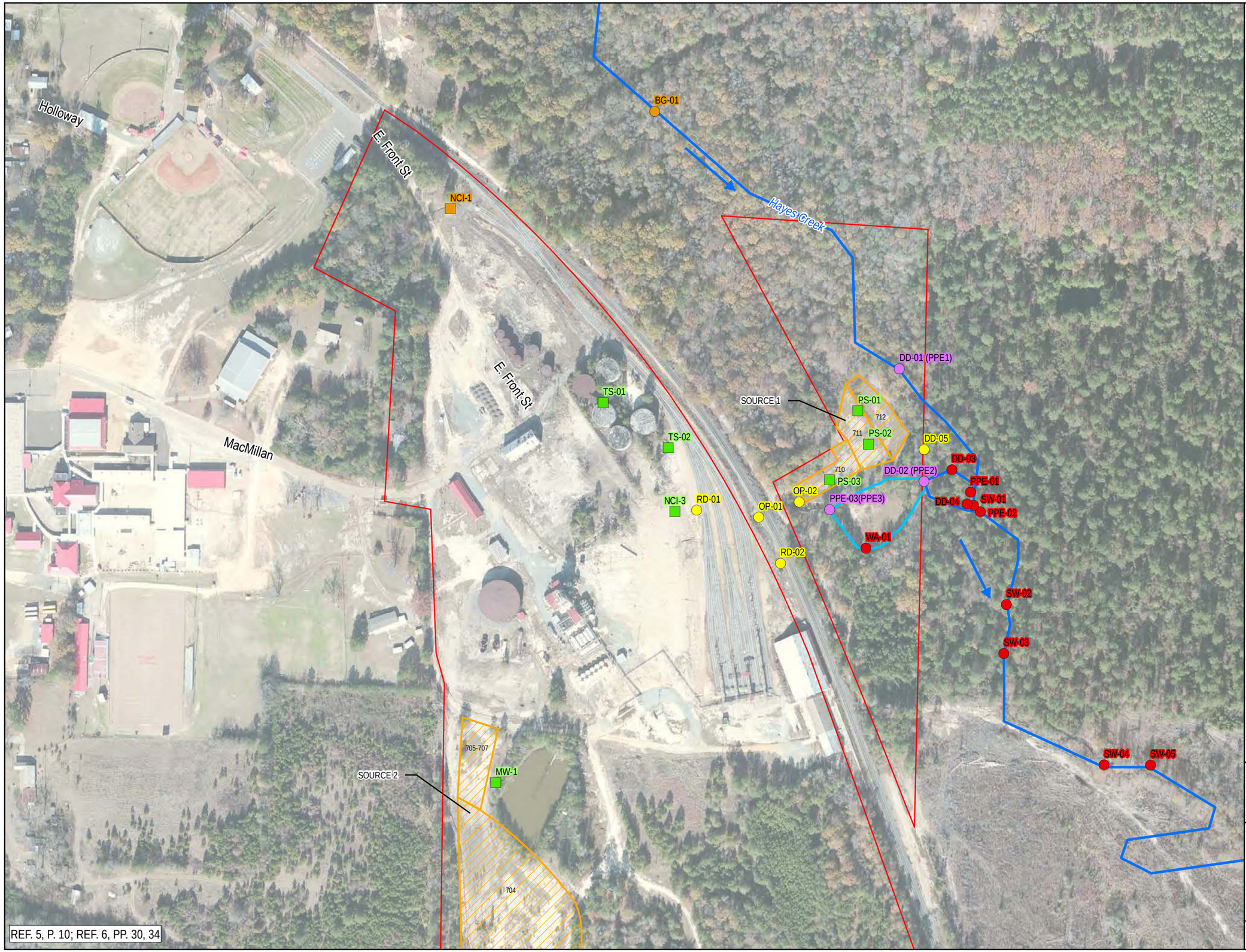
US EPA REGION 6

FIGURE A-4
15-MILE TARGET DISTANCE LIMIT
MACMILLAN RING FREE OIL CO. INC.
600 MACMILLAN RD
NORPHLET, UNION COUNTY, ARKANSAS

DATE	PROJECT NO	SCALE
SEPTEMBER, 2013	20406.012.019.0718.01	AS SHOWN

10:21:11 AM 9/6/2013

FILE: L:\20406_START3_R6\NORPHLET_CHEMICAL\GIS\FIGURE_A-4_15-MILE TARGET DISTANCE LIMIT.mxd 10:21:11 AM 9/6/2013 bondp



LEGEND

- BACKGROUND GROUNDWATER SAMPLE
- BACKGROUND SEDIMENT SAMPLE
- LEVEL II SEDIMENT SAMPLE
- PROBABLE POINT OF ENTRY
- SEDIMENT CHARACTERIZATION SAMPLE
- SOURCE CLASSIFICATION SAMPLE
- SURFACE WATER FLOW DIRECTION
- LEVEL II WETLAND AREA
- PROPERTY BOUNDARY
- FORMER PONDS

N

0 250 500

Feet

TDD NO: TO-0019-12-03-01
CERCLIS NO: ARD008049207

US EPA REGION 6

FIGURE A-5
SAMPLE LOCATION MAP
MACMILLAN RING FREE OIL CO. INC.
600 MACMILLAN RD
NORPHLET, UNION COUNTY, ARKANSAS

DATE	PROJECT NO	SCALE
JULY, 2013	20406.012.019.0718.01	AS SHOWN

5:50:25 PM 7/30/2013

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